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EDITORIAL NOTES—GAS, &c.

Suction Gas—As Advertised and in Practice.

THERE is a certain class of advertisement in which a considerable amount of latitude is magnanimously allowed. As a rule, a majority of the public show a fair amount of skill and shrewdness in properly appraising the statements of the authors of such advertisements, although a still not inconsiderable proportion give as much credence to them as, for example, in mediæval times people gave to traditional superstition. A paper that Mr. R. M. Carr, the Electrical Engineer of Leek, read at the recent meeting of the Municipal Electrical Association at Brighton brings to mind a case in point. From the first, it has been patent to those technically acquainted with the subject that the cost and other claims of some of the suction and pressure gas plant manufacturers were not so comprehensive as was desirable to ensure that subsequent working results should supply testimony to the probity of the advertisements. We, as town-gas representatives, are not interested in the matter in relation to steam plant, which is the plant with which comparison is made by Mr. Carr when considering respective merits for central station working. In a measure, this gentleman may be said to be disinterested in his comparison, though, having pressure-gas plant (which has kinship with the suction-gas variety) in operation at his station, he naturally desires to make out for it the best possible case. Therefore, he can be declared free from prejudice, as against suction or pressure gas plant, in what he has written in his paper. This, from our point of point, makes certain of his statements of some value to the vendors of town gas. He gives credit to suction or pressure gas plant for securing a better thermal efficiency than is possible with steam plant; and (omitting consideration of the steam-turbine), it may be submitted, as a generally acceptable rule, that, below a certain capacity, a gas-driven electricity station costs less than one that is operated by steam, though, as the capacity increases, the figures are reversed in favour of steam. Another advantage to the small central station is that it is easier with gas-driven plant than steam plant to cater for a heating and power load. Gas-driven generating sets give a decidedly greater range in dealing with the diverse business and loads that fall upon a fortunate electricity station of the lower magnitudes in the matter of capacity.

Having made this preface to show the attitude of the author of the paper, we are at liberty to examine the parts of it in which there is for us especial interest, inasmuch as the experience of the author (who is an engineer, which the ordinary manufacturer requiring power, as a rule, is not), must also be the experience of the manufacturer who forsakes, on the seductive representations made to him, the always available town gas for the so-called cheaper suction or pressure gas plant. The adoption of this plant means the introduction of fresh trouble into a works or factory, so as to obtain the advertised lower cost per brake-horse-power. But the manufacturer is soon undeceived. Mr. Carr puts the matter bluntly when he says: The advertised figures of some of the makers of gas-engines using producer plant of the kind are "seldom, if ever, realized, under the "ordinary working conditions." Working conditions vary greatly; and it may, with a fair amount of confidence, be said that it is impossible in any factory to realize certain of the advertised results under the conditions and on the fluctuating loads that more often than not obtain, which are not in any sense the equivalent of the conditions under which the makers of the gas plants and engines would obtain the best possible out of their productions. It is admitted that the bare fuel costs of such plants are below those of a steam-driven plant of similar capacity; but there are other expenses which run up the cost of the one as compared with the other, and which have a substantial bearing upon the question of economy. Particularly is this the case in the matter of repairs and maintenance of engines which, in Mr. Carr's opinion, will be somewhat greater, after a few years' running, for gas-engines driven by suction or pressure gas than for steam. It is clear that, employing town gas, the item of repairs and maintenance is not anything like what it would be—given similarity of age of engine, and conditions of working—using the product of suction or pressure gas plants. Moreover, with town gas, there is not any plant beyond the engine that is the equivalent of the suction or pressure gas plant for the gas-engine user to keep in order. It is not a matter altogether to be marvelled at that there is a difficulty in obtaining really reliable figures for repair and maintenance in connection with the plants under discussion.

There are other points that the author of the paper finds are not borne out in practice. Representation is made to the factory owner that the labour and attendance required for these plants are of a character that may be said to be negligible. It might almost be thought, from the statements made by some factory owners as to the representations of the "bag-men" of the makers of these plants, that a little child would suffice in the way of labour and attendance—the plant, in fact, can take care of itself if periodically fed with a few buckets of coal. It is found by Mr. Carr that a great number of the failures one has heard about are attributable to lack of knowledge and experience on the part of the attendants, and that there must be systematic and intelligent cleaning and attention generally if the plants are to be prevented from breaking down. In the paper, the misrepresentation to which allusion is made here is dealt with tenderly; but it is easy to see it is not of so insignificant a character that Mr. Carr's experience will allow him to countenance it as being of the nature of a venial sin.

The trouble from the clogging of valves by tar (a sawdust scrubber notwithstanding) is also spoken of; but this can be remedied at the expense of additional labour and time occupied in cleaning an obstructor to the tar placed near the gas-inlet to the engine. A further difficulty, involving additional labour and expense—light upon which comes after experience—is the disposal of the effluent from the washer of a producer plant. This effluent should never be turned into sewers while hot; if it is, it is certain there will be trouble. It seems that Mr. Carr has recently been taken to task by the County Council for allowing the washer effluent to find its way into a stream; but he is endeavouring to get over the difficulty by, instead of allowing the water to run away in a continuous stream, circulating it by means of a pump and tanks, and treating it with lime. This treatment has the effect "of throwing down sulphur compounds "in the form of mud," after which only a small quantity of the heated liquor is allowed to flow into the drain at intervals. There is, however, no certainty yet that this treatment and procedure will completely suppress the difficulty; but it is a trial that is being made at Leek.

It must not be supposed from this that Mr. Carr is writing against the use of suction and pressure plants. On the contrary, for his purposes—for an electricity generating station—he approves of them. But if he, a trained engineer, finds these difficulties, how much more will the factory owner, untrained and unskilled in engineering affairs, find them intensified. If, further, the managers of central electricity supply stations up to a given capacity are satisfied that suction-gas or pressure-gas driven engines are more suitable and more flexible for their use than steam-driven plants, is it not possible that, from the neighbouring gas-works, a supply of gas of even quality and purity—ensuring steady running, and avoiding the evils mentioned and others unmentioned—could be obtained at a price that would be worth paying to be free from the annoyance and expense caused by the suction or pressure gas producer? But perhaps there would be the objection to this that the use of town gas by the electricity station would be a good advertisement for the local competitor. But the fact of the use of the gas-engine remains, no matter the source of the gas. However, it is interesting to see this development of the use of gas-engines in central electricity stations, at a time

when, for the new forms of stoking machinery in gas-works—for the three acts with one machine of traversing the floor, and propelling and raising and lowering the working parts—small electric motors are found to be more serviceable and convenient than other forms of power.

High-Pressure Transmission and Out-Districts.

THERE are two themes that if both were missed in these times at any one of the annual meetings of the premier gas organizations of the world, the meeting would be looked upon as being abnormal in its technical character. The topics are carbonization and high-pressure gas distribution; and both are destined to play an important part in the economies of the gas industry and in enlarging the ability of the industry to serve. The subject of high-pressure distribution engaged the members of the German Gas Association at their recent meeting, through a paper contributed by Geh. Baurat E. Blum; and an abbreviated translation of the communication was published by us last week. High-pressure distribution schemes on the lines of the systems described by Herr Blum have of late been commanding the attention of gas engineers at home, especially the Tynemouth schemes carried out by Mr. William Hardie, whose communication upon the subject to our columns and the detailed particulars supplied in a paper to the North of England Association by Mr. F. C. Willis, are valuable contributions to the technical literature treating of this matter. The paper, however, that is fresh before us—that by Herr Blum—not only imparts information, but it throws further light upon the strenuous application of our German gas-engineering friends in their admirable intention to be second to none in the matter of gas achievement.

They early appreciated the economies of high-pressure distribution, and how the system widened the horizon of the gas engineer. They quickly saw that it placed a valuable commercial asset in their hands by enabling them to push out their business boundaries, and so to economically incorporate outlying townships and areas. The economy does not end with the initial cheapness with which districts can be linked-up with a distant gas-works through a high-pressure system. Outlying areas of the kind in mind are difficult of approach for heavy goods such as coal; and therefore carriage to them is often very expensive. The capital, manufacturing, and administrative expenses of a small isolated works for such areas are greater per unit of output than are those for a works the operations of which are on a larger scale. Generally speaking, too, the increments of business to be picked up in surrounding areas by the latter gas-works contribute to their economical operation. Therefore, from whichever way viewed, high-pressure distribution is synonymous with economy, and, through its aid, we shall, as time progresses, see the process of the centralization of gas production greatly developed. Furthermore, it largely increases the resources and power of a progressive and economically managed gas concern; and, in themselves, the high-pressure main and the pressure-raiser constitute a reserve which no low-pressure main, simply controlled by holder pressure and governors, can claim. The high-pressure main that carries a pressure sufficient for the needs of to-day will, as the demand for gas increases, have its carrying capacity increased by the simple means of raising the pressure of the gas. This has all been fully realized by German gas engineers; and the larger works have been silently but rapidly making use of the growing knowledge in linking-up the out-townships to the central gas-producing establishments.

At home, the electrical industry has been, through the power companies in certain quarters of the country, essaying much the same sort of thing. But the power companies are at a disadvantage compared with gas undertakings, in that they are comparatively modern creations, and their capital expenditure is heavy—in fact, in electricity supply generally, the capital expenditure on the basis of "per consumer" or given volume of business done is heavier than in the case of gas. However, the electrical industry is keeping close observation on the outer and rural areas; and it is looking (this apart from the power companies) to being allowed the facility of feeding these areas by the cheap system of transmission provided by overhead wires. The Government Departments do not like the idea; but periodically there are fresh attempts made to obtain sanction to some such system. There are also the coke-oven owners who are keen on marketing their gas by the aid of high-pressure transmission. There is in the paper further discussion of the coke-oven gas question. But the main point is that to be first in the field is an important consideration which gas engineers will keep in sight. With the advantage of high-pressure gas transmission at command, the work of bringing into business communication the outer districts is greatly facilitated; and there should be no hesitation if the present conditions or immediate prospects warrant.

In this paper of Herr Blum, there is not technically a great deal beyond the descriptive part, and the record of progress in Germany, that was not formerly in possession. He finds a useful place in high-pressure practices for both turbo-blowers and compressors, and emphasizes the necessity of good automatic control and regulation, so that the quantity of gas transmitted corresponds constantly with the consumption. There are many interesting problems surrounding this question of automatic regulation; and it is a subject that will engage more and more attention. Among other subsidiary points, he touches upon the controversial one as to the effect of high pressures upon illuminating power and calorific power. There is just the spice of dogmatism in the remark: "The old idea that illuminating "power suffers through high compression is no longer "tenable." Continental investigations confirm Herr Blum; investigations in America and in this country, so far as they have been conducted, do not. What has been found here (further experiments are, we hope, being made to corroborate or reject past findings) is that illuminating power suffers some deterioration, and calorific power to a less degree—in fact, the latter is almost of negligible quantity. It is, however, an interesting point upon which further experiment—under various conditions of pressure and with straight coal gas and mixtures of coal and carburetted water gas—will be useful and interesting.

Another point raised in the paper is the importance of gas that is to be transmitted at high pressures being free, or comparatively free, from naphthalene; and naturally this led Herr Blum to establish a compatibility between the low naphthalene content of vertical retort gas and high-pressure transmission. The risk that Herr Blum sees is not of naphthalene stoppages effected by condensation from the gas by the cooling of the compressor (which is never so effective as to prevent a slight rise of temperature of the compressed gas), but of cooling *after* it has been compressed. It is quite easy to realize the trouble that the separation of naphthalene might cause in a long-distance main controlling the supply of an entire district, in addition to the smaller drawbacks of deposits lessening the carrying capacity of the main, or producing some considerable pressure loss by the friction caused by naphthalene-coated mains. The chief value of Herr Blum's paper lies in its suggestiveness.

A Pipe Contract and Want of Candour.

THE litigation in which the Staveley Coal and Iron Company and the Lincoln Corporation have been involved in connection with claims made in respect of a pipe contract, has ended, in an almost dramatic fashion, by the complete surrender of the former. The Lincoln Corporation have been fully justified; and the Staveley Coal and Iron Company frankly acknowledge that, in this matter, through an attempt on the part of some one or more persons connected with their staff to cover the more than ordinarily numerous rejections of pipes by the Lincoln Corporation representatives, there has been fraudulent proceeding within the works unknown to the management. The fraud committed, and now acknowledged, was that the numbers of certain rejected pipes had been tampered with by the alteration of the terminal figures, and the pipes thereafter sent forward to Lincoln as having been passed by the Inspector. The allegation was a serious one, so serious that (attaching to a Company of the reputation of the Staveley) the limits of a single contract could hardly embrace the mischief that such an indictment would inflict. The confidence of the Lincoln Corporation in the matter, however, under such circumstances, is a very striking feature of the case; and in the prospective interests of the Staveley Company, it is to be deplored that there had been such an effective covering up of the tracks of the fraud that it was not found out by the management before being brought into open Court. Six sittings were occupied before information came to the knowledge of the management that induced them to take the only course open to them—admit the complete truth of the allegations of the Corporation, acknow-

ledge that the management had been wholly deceived, pay the Corporation £3000 under their counterclaim, and bear the whole of the costs of the action. These costs will amount to several thousands of pounds if Sir Edward Carson's estimate of £3 10s. a minute is correct; and all this, and all the trouble and worry, because someone on the staff, to preserve his own skin, had not the candour to admit a fault. Such a course, too, would have saved the reputation of the Company from being dragged in the mire. No one will believe that the management of the Staveley Company were cognizant of the fraud; but affairs of this kind have a way of leaving behind some indelible marks. That is the cruellest part of the business for a Company of such standing. But was the investigation of the charges sufficiently severe, under the circumstances, before entering upon litigation?

Seismic Disturbances and Gas-Mains.

It is something for which British gas engineers may be grateful that they are not subject to the property and nerve-wrecking disturbances to which some of their *confrères* are, through earthquakes, in more distant parts of the earth. There have been of late years the earthquakes in San Francisco, Valparaiso, and Messina, which have played sad havoc with the plant of the gas undertakings. Then there has been the more recent one in Mexico, which has fortunately not had any really serious effects on the Gas Company's property. One reason for this is that (as explained by Mr. Charles D. Lamson in an article reproduced by us from an American gas contemporary), in laying out the works and plant, special provision was made to meet any subterranean visitation of the kind; but a still further reason may have been that Mexico escaped such severe disturbances as were experienced by San Francisco and the other places mentioned. However that may be, the Mexican National Gas Company had stresses and strains put upon their manufacturing and distributing plant which proved that, to the extent of the violent test, the precautionary measures taken in designing the plant and distributory system were efficient and sufficient. The experience will be useful in other countries prone to seismic disturbances; and not altogether valueless in places where mains are subject to a great deal of vibratory motion. In our great cities and towns, the gas canalization is subject to more vibration than a few years since, through the altered character of the traffic—higher speeds and heavier weights having now to be taken into account. It speaks well for the sound methods originally adopted in laying the distribution systems that so little additional unaccounted-for gas has been experienced in consequence of the changed conditions in respect of road usage There are worse enemies of gas and water pipes below the surface of the roadway than the vibrations and stresses set up from the surface.

The description in Mr. Lamson's article of the precautionary methods adopted is instructive. Flexibility is the pre-eminent safeguard. It is found freely on the works, and equally so in the district. On works, pipes are constructed of riveted steel plate, and are carried on hanger supports and roller bearings, while there is liberal use made of expansion joints at points of connection. The guide-rollers on the gasholders have also springs behind them which allow of plenty of play to the lifts. In the district the low-pressure pipes are of cast iron with bell and spigot joints; the only difference from ordinary practice in respect of these appears to be in the yarning and leading of the joints. The difference is not explained in detail; and it would be interesting to know more as to what really constitutes the variation in practice. The high-pressure pipes are freely fitted with expansion joints—on the average about eight to the mile; and these are placed in chambers so as to be easy of periodical inspection and repair. Previous investigators have advocated a telescopic form of pipe-joint for the purpose of meeting the longitudinal strains to which pipes are subject under similar circumstances. There is one thing that Mr. Lamson's instructive article lacks, and that is a brief descriptive interpretation of terms—such for example as "expansion joint." To distributing engineers at a distance, it would be helpful to know that what they have in mind from pure conjecture as the type used is the actual thing employed. For bends in a line of pipes, Mr. Lamson finds from this Mexican experience that a good radius is the best with long joints. The point in the distribution system at which the greatest damage was done by the earthquake was where service connection is made with the mains. What is advised where services are tapped into mains is the use of brass elbows and service tees put together with graphite and oil applied to the male threads. These, it is said, will give absolute insurance against ruptured mains and sheared service-pipes. The conclusions at the end of the article sum up the instruction to be derived from it.

Practical Street Lighting.

It was a practical paper that Mr. H. E. Copp, of West Bromwich, read at the recent meeting of the Institution of Municipal and County Engineers, on the subject of street lighting. It was a paper that was not written for gas or electrical engineers, but for municipal engineers, who, while they have in most cases a considerable amount of influence in the matter of the lighting of our public thoroughfares, have not the same opportunities, owing to the multifarious duties devolving upon them, of making so close a study of the important details of the subject as gas and electrical engineers. The occasion for the presentation of a paper of the kind was a good one; and it reminds that, some time since, attention was called in these columns to the fact that gas men do not (as do electrical engineers and the makers of producer-gas plants) make sufficient use of the platforms of societies unassociated with the gas industry, but the members of which can, if kept informed of the advances of the applications of gas, be influentially useful to the industry. The members of the Institution of Municipal and County Engineers will, as the result of Mr. Copp's paper, have left the meeting, and travelled to their several spheres of action, fully impressed with the facts that for public-lighting purposes gas is well in front, and that its potentialities are such that the last word upon its advances will not be uttered in any immediate period, if ever. It is to be hoped that work of this kind among technical organizations not directly connected with the industry, but having influence on its trading, will be pursued with greater diligence in future.

Upon the subject-matter of Mr. Copp's paper, there is not a great deal to be said, seeing that it is very much, if not completely in every minor matter, in accord with the opinions generally held in the industry. Two points are very clear. The first is that the municipal and county engineers are not so thoroughly versed as they should be in the utility of the inverted gas-burner compared with the upright for ordinary street lighting. This is a matter that gas engineers should at once seek to correct. Few among those who were at the meeting had, prior to Mr. Copp's paper, any notion as to the economies of inverted burners, both in gas and mantle consumption. The figures regarding mantles that Mr. Copp gave, show that, in a lantern he has designed—by which he utilizes the misdirected rays from an inverted burner, and redirects them where they are required—the use of mantles only averages four per annum, as compared with 8·3 with the old "C" upright burner. There is another point that it is plain is taking strong hold of municipal engineers, and that is the uneconomy of the lamplighter, through the necessity of an early commencement of lighting and a late ending of extinguishing by the individual treatment of the lamps, as well as the delay that is occasioned in lighting-up under such exigent conditions as sudden fogs. Where automatic means are not adopted for doing the work—either by pressure or by clock-work control—there is no doubt that gas lighting, in this one respect, shows up unfavourably, in the public eye, in contrast with electricity. Sooner or later, through force of circumstances, the lamplighter will have to go.

Education and Training of Engineers.

Since the conference arranged by the Institution of Civil Engineers on the subject of the education and training of engineers, there has been in the technical and daily press a considerable addition to the outflow of the occasion. But from all the comment passed upon the proceedings, it is difficult to find very much in the way of hopefulness of any real good coming out of the proceedings. On the contrary, most writers, whatever they may have felt, have been careful not to say so in unequivocal terms. The impression that the proceedings made upon us was that it had been a fine opportunity for showing that the ideas and views existing on the subject are so varied and hostile that any selection and synthesis of ideas into a generally acceptable scheme would be quite out of the question. The views expressed in our

columns have the endorsement of the Engineering Correspondent of the "Daily Telegraph." He remarks: "In the matter of training for engineers, we shall never reach finality; and it is doubtful whether we shall ever reach a time when everyone is agreed as to the best method to be pursued. Indeed, it is probably undesirable that either of these things should take place. About 150 engineers discussed the subject, and almost as many different plans and opinions were suggested. The parent anxious to place his son into engineering work may well be advised not to read the report of the proceedings, or he will, indeed, wonder what is the best way to set about the matter."

The Trades Union Congress.

The greatness of the changes wrought by time is the subject of frequent reflection in connection with many matters—but not with regard to the programme of the Annual Trades Union Congress, which does not exhibit any very pronounced tendency towards wide variation as the years go by. The *agenda* for the forthcoming gathering—which will take place at Newcastle-on-Tyne during the first week in September—bears in some respects a strong family likeness to its predecessors; but we are told that the number of resolutions to be considered shows a slight increase on those dealt with last year. It may be imagined that many people will confidently assert that they can readily perceive the reason for, and the unreasonableness of, at any rate the one which desires the congress to state that, "realizing that militarism and the existence of a regular standing army constitute a menace to popular liberty, it is of opinion that the time has arrived for the institution of a real citizen army, free entirely from military law during time of peace, officered entirely by the selection of the rank and file, and to be used for defensive purposes only." Then a smaller matter will be dealt with in a motion calling attention to the "want of civility and the careless way in which the Registrar-General's department is conducted when dealing with Trade Societies on the registration of rules;" while other delegates will suggest that, as the extensive powers exercised by the higher permanent officials in the Government departments is detrimental to the democratic progress of the nation, it is essential that the business of each department should be controlled by a Standing Committee representative of all parties, elected periodically from the House of Commons. There is a suggestion that the Government should be approached, with the idea of persuading them to appoint a Royal Commission or a Parliamentary Committee to inquire into the whole field of industrial life assurance, with a view to its nationalization. A resolution of the "Practice principles" order is that which recommends that all Trade Unionists should wear only those boots and shoes which bear the Trade Union stamp. The National Insurance Bill forms the subject of a number of motions; and there have been placed on the *agenda* no less than five propositions relating to mines. The appointment of a Commission is to be asked for to inquire into the operation of the Workmen's Compensation Act from the point of view of its effect upon unemployment, especially as concerning workmen advanced in years, through the higher premiums required by the Insurance Companies. The resolution favouring the nationalization of railways and canals we have met with before; but a less familiar, though quite as ambitious, idea is that of the Parliamentary Committee—to ask for a Royal Commission "to inquire generally into the present method of administering justice as between plaintiff and defendant."

Competitive Prizes Offered by the Société Technique du Gaz.

We are again reminded by a circular received from the French Gas Society of the different classes of competitions, available to all, offered for the year 1911-12. They are for nearly all kinds of apparatus showing marked progress (1) in apparatus for gas manufacture; (2) in the industrial and domestic use of gas; (3) incandescent burners; (4) automatic distance lighting; (5) poor-gas or water-gas producers; and (6) for industrial or domestic apparatus for using gas coke. The last-named class is provided by the Comité Central des Cokes de France, which offers four prizes, one of 5000 frs., a second of 3000 frs., and two of 1000 frs. each. We should imagine that, in view of recent improvements made by certain English manufacturers in industrial and high-pressure gas apparatus, some British competitors ought to be forthcoming with a reasonable chance of success in some one or other of these categories. Full particulars can be obtained from the Société Technique du Gaz at No. 94, Rue Saint Lazare, Paris.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 195.)

Taken all round, the Stock Markets had a much more pleasant period last week than the week before. It had one big black spot in the weakness of Consols, which created a record for themselves by falling on Tuesday to 78 $\frac{3}{16}$—the lowest price touched since they became a 2½ per cent. stock. Happily, this price would seem to have cleared off the last of a large block awaiting liquidation, and a rapid move upward set in. Apart from the premier security, the general tone was cheerful, and the settlement produced no anxiety. The opening day was fair in most lines. Rails were rather buoyant; Americans stronger; the Foreign Market calm and steady. But Consols fell to 78½. On Tuesday, they were down to 78 $\frac{3}{16}$, as stated above; and other of the gilt-edged class were unsettled in sympathy. But the other leading departments bore up very well. Wednesday brightened up considerably after the passing of the storm cloud; even the much tried Government issues being cheerful. Prices rose everywhere; Consols gaining $\frac{3}{16}$. Rails were strong and full of rise; and the chief markets participated. Thursday was another happy day. Consols improved $\frac{5}{16}$; and Rails continued to advance. Friday produced a good bit of profit-snatching after the sharp rises, and Consols were rather knocked about by some professional operations. Rails also suffered to a less extent. Saturday was very quiet; but the tone was pretty good. Consols were firmer at 78 $\frac{7}{8}$-79 $\frac{1}{8}$; Rails and other chief markets were generally firm. In the Money Market, the supply was superabundant, and could only find employment at very cheap rates. Discount terms were easier. In the Gas Market, business was moderate only—suffering perhaps from the extreme heat of the weather. The general tendency was firm and unmoved, with but few changes in quotation. In Gaslight and Coke issues, transactions in the ordinary were below the average. But prices were very steady; being within the same limits as the week before—106 $\frac{3}{8}$-107½. The secured issues were rather more brisk; the maximum making from 85¾ to 87, the preference from 103½ to 104½, and the debenture 78¾. South Metropolitan continued quiet and unchanged, realizing from 119 to 120½. In Commercials, the 4 per cent. changed hands at from 114 to 115½, the 3½ per cent. at 108¼ and 109, and the debenture at 76½. Among the Suburban and Provincial group, Alliance and Dublin was done at 83¾, Brentford new at 205½ (with a nominal quotation of 200-210), Brighton ordinary at 160, South Suburban at 120 $\frac{3}{8}$, Tottenham "B" at 118, and (on the local Exchange) Liverpool "A" at 216. In the Continental companies, Imperial was very quiet and rather easier at 183½ to 184½, Union realized 94¼, and European 19 $\frac{5}{8}$ and 19¾ Among the undertakings of the remoter world, Bombay fully-paid changed hands at 6 $\frac{9}{16}$, Cape Town debenture at 80, Primitiva at 7 $\frac{7}{16}$ to 7 $\frac{5}{8}$, ditto preference at 5 $\frac{5}{16}$ to 5 $\frac{7}{16}$, ditto debenture at 97 $\frac{1}{8}$ and 97¼, River Plate debenture at 95¾ and 96, San Paulo at 21½ and 21 $\frac{7}{8}$, and ditto preference at 12¼.

ELECTRICITY SUPPLY MEMORANDA.

A Discovery by the "Electrical Times"—Chairman and Engineer—Profits and Other Topics—The Wiring Barrier—Depth of the Mark of the Electrical Illuminations—Up Against the British Gas-Engine Makers—Costs.

The "Electrical Times" appears to be the first among the electrical papers to discover there is anything worth writing about in connection with the lighting and power arrangements at the Crystal Palace. The heading to the descriptive article that it has published is "Electric Lighting at the Festival of Empire"—not "High Pressure Gas and Electric Lighting and Power." The writer of the article just manages to screw out the information that the North Nave of the Palace is illuminated by high-pressure gas-lamps; but the fact that the whole of the main lighting of the exhibition grounds is also by high-pressure gas-lamps, representing a total of 657,000-candle power (exclusive of the 107,600 candle power in the North Nave and Side Courts, and that of the lamps outside the Palace), seems to have been lost in the deep recesses of his mind in the strain occasioned by having to keep electricity in the forefront. Not overmuch is said as to the point that the whole of the electricity required in the exhibition buildings and grounds proper, save in the Canadian section, is supplied by gas-driven electric plant put in by the South Suburban Gas Company. In reading the article, too, we have missed—we hope not inadvertently—any reference to the fact that this same gas-driven plant furnishes the whole of the energy required by the "All Red Route." The fact has also been overlooked that the gas-driven electric generating plant represents the result of competition between the local Gas Company and the local electric supply undertakings. We see from the article that it is proposed to have an official inspection of the lighting and power equipment as soon as the plant in the power house is in full commission. When electrical journalistic friends make this inspection, they may—we think with all modesty—find some useful assistance in the descriptive article in the "Journal" for May 16 last. At any rate, perhaps they will favour the gas industry by not omitting the points to which we have alluded, and moreover not fail to give honour to whom honour is due. It is remarked that the "Electrical

Times" states that the power house was put down by the South Suburban Gas Company, to the designs of Mr. Albion T. Snell, the Consulting Engineer to the Festival. Mr. Snell, we are sure, would be the last to wish that undeserved honour should be placed upon him by the other electrical papers; and therefore, if those papers will consult the plan printed on p. 443 of our issue for May 16, they can rectify to the full the error of their electrical contemporary. At any rate, drawings for the power house were prepared elsewhere than in the office of Mr. Albion T. Snell. How our contemporary came to make the blunder is a mystery. [Since this was put in type, we see the "Electrical Times" has made, in an unpretentious paragraph, the *amende honorable*.]

Returning to the proceedings at the Brighton meeting of the Incorporated Municipal Electrical Association, it is found that there is a large amount of dissatisfaction with the quality of the papers on this occasion; and wise counsellors have come to the front advising the Council as to what they should do in future. This external interest must give the Council much joy. One of the papers read was by Mr. Councillor Leese, the Chairman of the Stoke-on-Trent Electricity Committee; and his method of dealing with certain points seems to have grated on the ears of the municipal electrical engineers present—so much so, that he was asked point-blank whether he found any use for an electrical engineer in running the concern for which he is responsible head. Mr. F. Ayton (of Ipswich), for example--the "Electrician" says—took Councillor Leese severely to task for abrogating [*sic*] to himself, as he thought, the duties of chief engineer." This was not very generous; and it was not courteous. When a Chairman is speaking as Mr. Leese was doing, it must be taken that he is doing so from the responsible position in which he has been placed. We doubt not that Mr. Leese would be the last person to arrogate to himself a knowledge on technical matters superior to that of the Engineer with whom he works, and that he would admit that his views on technical questions are moulded entirely by the advice of the Engineer. There ought to be ability, from the knowledge generally possessed by engineers, to judge of the actual weight to be attached to words employed by one in the position of Mr. Leese. His paper was on "Electricity Supply Viewed from the Municipal Committee's Standpoint."

The communication contained some sound reasoning and argument. Mr. Leese is against profits going to the rates. On the great federation of Potteries towns (of which Stoke-on-Trent is a component), Parliament put an end to the profits being diverted to that object; and a good thing too. Mr. Leese pointed out one way in which injustice is done by electricity profits being used for lightening the rates. Take, as an instance, a large manufacturer who is using a considerable quantity of energy at the lowest fraction of a penny at which the Committee supply for power purposes. He is obtaining a large personal benefit from this, and yet his rateable value being heavy, he gets one of the biggest pulls out of any electrical profit appropriation in aid of the rates. Incidentally, Mr. Leese is not of opinion that charges for power are correctly determined. He thinks that they should be compounded of the costs of generation added to the cost of distribution in each individual case. One manufacturer may be quite close to the generating station, while another may be a considerable distance from it; and the one at a distance may be the cause of an expensive line of cable being needed. Among the speakers was Alderman Pearson, of Bristol; and he says it is found necessary there to "cut" prices for electricity for power, in order to compete with steam and gas. This frank acknowledgment is worthy of Alderman Pearson, who has in the past been subject to much criticism both in and out of Bristol. As to the disposal of profits (where there are any), there was general agreement that they should be used for the benefit of the undertaking and the consumers. Mr. Councillor Good, of Maidenhead, thought profits should be divided equally between the reserve fund, the consumers, and the reduction of charges for street lighting. On the other hand, Alderman Smith, of Liverpool, was against allocating profits made from private consumers to street lighting, more especially seeing that the charges for current for street lighting are already low. Electricity suppliers find the charges have to be low in order to compete with gas, notwithstanding the queer assertions that, at much higher prices per unit, electricity is cheaper than gas for private lighting. It is difficult to reconcile electrical arguments. Alderman Smith was also against Electricity Departments having control of the street lighting. The remark it was stated was met with a "chorus of groans." The selfishness of Electricity Departments was expressed by those groans. It does not conduce to good administration where there is competition for a public service, for one of the competitors to be both seller and purchaser, and to have control of the service in question. There was also some talk in connection with this paper as to the encouragement of electricity for cooking and heating. We heard again about the cables in many streets being insufficient for transient heavy loads when cooking might be in progress at the same hour. Combining with the heavy capital expenditure that would be necessitated for new cables, the fact that (according to Mr. Leese) cooking-ovens costing £5 each are flimsy things, and that a price of £10 puts the electric oven out of the running with the first expense for a gas-cooker, the big development of this business that the electricity engineer says he would like is beyond the range of practicability.

There is only one more barrier to be negotiated before the electrical industry enters into full possession of the lighting field. At least so we gather from a paper on wiring methods by Mr. J. W. Beauchamp read at the same meeting. Being Chief Electrical Engineer of the Tunbridge Wells electricity undertaking, Mr. Beauchamp ought to know all about it. But it is obvious he is a long way in arrear in his knowledge of the history of the relations between the gas and electrical industry. That omniscient paper the "Electrical Review" long since was gloating over the death struggles of the gas industry in the last ditch, and nothing was then said about a barrier. However, we live; and, living, learn. At the same time, we do not accept all as gospel that has electrical origin. However, the last barrier, we are now informed, to the universal introduction of electric lighting, is the cost of wiring; and the electrical industry is asked to concentrate its thought and talents upon this point. But the paper and the discussion on it do not throw much guiding light on the path to be taken, which path, it is acknowledged, is beset with difficulties. The present wiring rules, the confident Mr. Beauchamp says, in effect, are all too complicated. Something simple has to be found in the way of a specification; and, when found, there must be insistence on its strict observance. There have been a multitude of schemes elbowing each other about in the electrical market place, all purporting to be good and conducive to cheap installation. But there does not appear to be anything yet—not even the much-lauded Stannos system—that is altogether free from fault and cheap per point of lighting. Caution and wisdom are seen in a sentence appearing in a comment made by the "Review" on the subject. It says: "Wiring may *perhaps* be made more reliable than the work of the gas-fitter; but it can *never* be so simple of specification." Well the difficulties of this particular barrier are immense; and most electrical engineers acknowledge it to be so. Many are for maintaining a high quality of work, and not jeopardizing established business by descending into "jerry" work in connection with small installations. The insurance companies, too, must not be overlooked; and landlords must be educated up to looking after their own interests, and not allow electrical installations to be made that may endanger their property. But talking of landlords, there are some electrical engineers who are still hankering after getting landlords of small property to become financially responsible for wiring installations; but if landlords are foolish enough to become responsible, then they had better see that the installations are of a character that will ensure them being in useful existence at the time the payments have finished. However, about that, in Mr. Beauchamp's view, only remaining barrier. We were going to suggest that modern gas lighting presented a few others; but we will not rub in facts only too well known to those who indulge publicly in make-believe.

They have a no small conceit of themselves in some quarters. "Electrical Industries," writing on "The Lesson of the Coronation," says: "Neither the solemn ceremonials nor the Royal processions, nor the pageantry, nor the profuse decorations, have made so deep a mark as the electrical illuminations." After this we ought surely to stand before the electrical industry in the deepest humility. But what is this? Notwithstanding the depth of the mark, "the public memory is short; and the attractiveness of electrical illuminations may soon be forgotten, and may remain forgotten, until some special occasion of rejoicing comes round." If this is so, then how frightfully shallow must have been the mark made upon human memory by the solemn ceremonials, the Royal processions, and the pageantry of the great occasion; and how quickly they must have faded away. Thoughts are not strikingly consecutive and in harmony in "The Lesson of the Coronation" paragraph; but the writer must feel greatly indebted to their gracious Majesties for having given the electrical industry a chance to make a deeper mark than they themselves could effect with all the gloriousness of, and ceremony attaching to, their Coronation. It is also remarked that the prophet and dispenser of good things is again at work on the "Electrician." Also writing on the illuminations, he remarks on the unfriendly attitude of the elements on the occasion towards open gas-jets. Then he proceeds: "Where an attempt was made to protect the gas-flame with small coloured globes, the result was practically the same; the rain quickly filling up the globes and effectually dousing the gas-jet." Where were these globes that were water-tight at the bottom? "Surely our gas-friends should see in these signs and portents 'the writing on the wall.' If the elements are arranged [? arrayed] against them in this unfriendly way, they should realize that the day of gas as an illuminant is gone." Has this funny man never found out the difference between an open gas-jet and (say) an inverted gas burner? "*We are quite prepared to give them their legitimate position for heating and cooking.*" This is really magnanimous; but the fact is that this prophet and dispenser of good things cannot help himself, though it was not such a great while ago that he was predicting the early change-over of cooking and heating to the electrical industry.

Some new generating plant is required for the Kingston-on-Thames electricity station; and, as in other quarters, there is a disposition to favour the internal combustion engine—gas or oil. The internal combustion engine has been much maligned in the electrical industry; but it is a case of the intensity of the bark not representing the degree of inimicality. The internal combustion engine, as a matter of fact, is making rapid strides in installation in the central electricity generating-stations of this country; and, as said above, Kingston-on-Thames is looking in this direction. The Chairman, Vice-Chairman, and the Electrical Engineer are proposing to have a trip to Germany to see what is to be found there in the way of internal combustion engines. According to a report in one electrical contemporary, the Chairman of the

Committee (Mr. Lambourn) stated, when the matter was before the Council, that the Committee were determined to get the best they could, and would certainly give a preference to English-made goods if they were the best. But it seems the Chairman had already made up his mind. What chance do the English-made engines stand (if he is correctly reported)? seeing that, "as far as internal combustion engines are concerned, whether gas or oil, there can be no question that Germany is far in advance of this country." What have the British gas-engine makers to say to this. The Council agreed to the proposed deputation; and we are now ruminating over the chances of the deputation coming home with a report that after all the Chairman was mistaken as to Germany being far in advance of this country?

When will electrical engineers learn more of the truth about modern gas lighting? Mr. A. Preston, the Electrical Engineer of Ammanford, writes to the "Electrical Review" on the subject of the advantages of free-wiring. He has a system under which three points are wired, and tungsten lamps with opal shades are fitted, on a payment of 5s. and energy at 6d. per unit. For extra lamps in bedrooms, &c., 6s. has to be paid. The tenant is held responsible for the lamps, and has to put them in thorough repair on leaving the house. Now Mr. Preston contends that this is the most economical light a labourer can use, inasmuch as he can obtain five-and-a-quarter hours' light from a 32-watt lamp for 1d., while the price of gas in the district is 4s. 3d. per 1000 cubic feet. The 32-watt lamp represents about 24-candle power. The same candle power can easily be obtained with a bijou inverted incandescent burner, using 1¼ cubic feet of gas an hour; and if Mr. Preston will trouble to make the calculation, he will find that about 20 cubic feet of gas can be bought for 1d., with gas at 4s. 3d. per 1000 cubic feet, and that 20 cubic feet will feed such a burner for about 16 hours. A 50-candle power inverted burner can be run for just about eight hours on a pennyworth of gas at the 4s. 3d. price. Does Mr. Preston see anything wrong about these figures? If so, we shall be pleased to hear from him, and to discuss the matter.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

Committees' Reports.

INSTRUCTIONAL AND EXPERIMENTAL GAS-WORKS.

THE following is an abstract translation of the report for the past year of the Technical Committee of the German Association which is charged with the administration of the Instructional and Experimental Works of the Association at Carlsruhe, as presented at the meeting at Dresden last month. The report is signed on behalf of the Committee by Herr F. Reichard and Professor H. Bunte, both of Carlsruhe.

Coal-Testing.

The chief work pursued at the Instructional and Experimental Works during the last year was the examination of coals typical of those carbonized in German gas-works; and this work will be continued in future. In subsequent years, however, it is intended to extend researches more in the direction of the application of gas; and a number of fundamental and preliminary investigations have already been put in hand with this object in view. In regard to the tests of gas coal, samples of the principal native and English coals used on German gas-works were provided by: The Berlin works of the Imperial Continental Gas Association, the German Continental Gas Company, the Thuringian Gas Company, the Industrial Association of German Gas-Works, the Danish Gas Company, of Flensburg, and the Corporation Gas-Works of Königsberg, Lubeck, Stuttgart, and Wiesbaden.

All told, about eighty different coals have been investigated, the greater part of which represent entirely different descriptions, though a few are of the same description from different sources. It is contemplated publishing the results of the investigations in a form accessible to the general public; but the Committee consider that a few palpable *lacunæ* should be filled, so as to make the report, when issued, as complete as possible in regard to the coals ordinarily used in German gas-works. Provisionally, therefore, they are merely publishing a list of the coals examined, in order that contributors may indicate the coals in which they are specially interested, and either receive the results already obtained in regard to them or provide samples of the coals in question for examination. The list comprises 29 different descriptions of Ruhr or Westphalian coals, 18 of Saar coals, 7 of Silesian coals, and 7 of coal from Saxony. It also includes 17 descriptions of English coal, of which 12 are classed as Durham and 5 as Yorkshire. The Durham coals are: Auckland, Boldon, Dean's Primrose, Lambton, Leverson's Wallsend, Londonderry, Low Laithes, New Leverson, New Pelaw Main, New Pelton Main, Old Pelton Main, and Wearmouth. The five Yorkshire coals are Hedwig's Pit Silkstone, John Locke's Silkstone, Star unscreened, Star nuts, and Walker. The list is tolerably complete as regards the Ruhr and Saar coals.

The practical and economical result of the investigations has already been displayed by different works taking the results of the tests into consideration in making their contracts of coal; while other gas-works have stipulated that their purchases of coal are made subject to the results of a carbonizing trial at the Experimental Gas-Works. In most cases investigations already made have afforded sufficient criteria so far as Ruhr and Saar coals were concerned. A comparatively large number of examinations were made on English coals; the proportion about corresponding to the proportion of English coal carbonized in German gas-works—viz., 25 to 30 per cent. of the total. The works having access to water carriage are those which use the bulk of English coal; but the number of varieties investigated does not even approximately represent the number of varieties coming on the German market. Having regard, however, to the importance of the coals of Upper and Lower Silesia, it is to be regretted that a larger number of representative coals from these districts have not been submitted for examination. Apparently, the works concerned do not appreciate the purpose of the investigations made at the Experimental works. Further endeavours are being made to obtain representative samples of more of these coals for examination. Apart from gas coals proper, a few other descriptions of coal have been examined in regard to their possible use on gas-works and their general behaviour on distillation.

The general examinations made by the Laboratory for gas-works have increased in number; and fees amounting to about £99 have been received for this work. Some forty samples of gas coal have thus been examined in regard to calorific power and content of volatile matter; and some twenty samples of coke, in which the question was mainly a comparison of the calorific value of gas coke and oven coke. Complete confirmation was obtained that a difference in calorific power depended solely on the proportion of ash or moisture being larger or smaller, and not on the origin of the coke. The report emphasizes the necessity for the greatest care in the taking of samples submitted for examination. It is pointed out that the most careful chemical examination of the samples becomes valueless if the samples are not representative. The Laboratory has issued a statement of directions for the taking of samples, which is printed as an appendix to the report. The substance of these directions is as follows:

Instructions for Sampling.

COAL OR COKE.

The coal or coke to be examined is sampled when a waggon is being loaded or unloaded by putting on one side in a basket or bucket every twentieth or thirtieth shovelful. The coal or coke so taken must contain the same proportion of large and small lumps as the consignment. The preliminary sample thus obtained should, if the coal or coke is in large lumps, amount to at least 6 cwt. This sample is to be spread on a firm, clean floor of iron or other hard material, and broken to pieces the size of a walnut. Care must be taken that hard pieces of slate are well broken. Lumps of wood or other extraneous matter should be rejected; but slate or other natural impurities of the coal should be retained. After breaking, the coal and coke are to be thoroughly mixed and spread in a square in a layer 3 to 4 inches deep. This square is to be quartered by two diagonals. The material in two opposite triangles is to be removed, the remainder is to be broken smaller—say, to the size of hazel nuts—well mixed, and spread out and quartered in the same manner as before. The same operation is to be repeated until a quantity of about 22 lbs. remains. This is to be retained in a well-closed vessel as the sample for examination. It is to be observed in the breaking and quartering described that in no case should the largest piece weigh one four-thousandth of the total of the sample at the time. If the determination of the moisture is of great importance, the sample must be prepared quickly, and hermetically sealed. Where the proportion of water is high, it is recommended that the whole of the original sample of about 6 cwt. should be weighed with care and spread in a dry, clean place till dry, then re-weighed, and a small sample taken from the bulk. In this manner the loss of water during the subsequent preparation of the sample is avoided. If the coals are in a store heap, samples of from 50 to 65 lbs. should be taken from at least ten different places, and mixed for the preparation of the average sample. The less uniform the size of the coal, and the more varied the amount of slate and moisture contained in it, the greater should be the amount taken for the first sample, and the more carefully should the breaking and mixing be carried out in order to secure a good average final sample. Such careful sampling of coal and coke is absolutely essential.

PURIFYING MATERIAL.

The same general directions apply for sampling oxide as for sampling coal and coke; but it is easier to break up, and it is only necessary to take care that clods are smashed with the shovel. The final sample should amount to from 4 to 6½ lbs., and should be packed in a well-closed glass vessel.

TAR.

In sampling tar from wells or tank-waggons, it should be remembered that tar may differ at different levels, and almost always does so in respect of the amount of water it contains. The sample should be taken by means of a plunger consisting of a pipe of from 2 to 4 inches in diameter. This pipe is slowly pushed down through the tar. After it has passed to the bottom of the tar, the lower end is closed by a plate with the help of a cord or wire attached to it. About 22 lbs. of tar constitute a suitable quantity for a sample.

Sundry Matters Investigated.

A number of samples of materials used on gas-works and of bye-products of gas manufacture were examined, including oil for

the extraction of naphthalene, fresh and spent purifying materials, gas liquor, benzol for carburetting, lubricating oil, &c.; but no special points arose in connection with them. Many samples of tar and tar products were examined, owing largely to the recent application of tar and tar oils as fuel in internal combustion engines. In consequence of disquieting reports as to the toxic character of gasholder tank water, due to the cyanogen it contains, a series of investigations was undertaken on seven samples of such water from different works. The water was found consistently to contain a very small proportion of cyanide and sulphocyanide; the amount being so small as to afford no justification for the rumours in regard to its poisonous character. Two samples of dust taken from service pipes were found to consist of oxide of iron mixed with elementary sulphur and some Prussian blue. The dust had doubtless been produced at some time through imperfectly purified gas. A number of examinations were made on different descriptions of gas-works' testing apparatus. The Laboratory is making a detailed investigation of the types of automatic flue-gas testing apparatus in use in Germany —viz., the Ados (two types), the Ökönograph, Eckardt, Pintsch, Strache's Autolysator (two types), and the Schultze-Krell. A report will be issued on these types of apparatus later.

Burners and Heating Appliances.

A number of burners, lamps, water-heaters, gas-stoves and cookers have been methodically examined with a view to ascertaining if they conformed with practical requirements. The effect of variations in the quality of the gas and of the pressure on different burners, regulating nipples, &c., is now carried out according to a routine method. The efficiency of various gas-stoves at different rates of consumption, and the influence of variations in the draught on them, were investigated experimentally. Various other investigations have been made on gas-stoves and also on water-heaters. The Association of Gas-Cooker Manufacturers has applied to the Laboratory for a set of rules for testing gas-cookers. The compilation of these rules is now in hand.

The Laboratory staff have carried out investigations at various gas-works. At Munich and Halberstadt, long period efficiency trials were made on gas-making settings. At Munich, a six days' trial was first made of the settings at the new Dachauerstrasse works; and very interesting results were obtained. In a subsequent four days' trial of the older settings at the Kirchstein works, the results of the longer trial tests made by the gas-works' management were confirmed. Thanks are expressed to several firms for gifts of apparatus to the Laboratory, either for the completion of its equipment or for the study of their working. The accounts of the Laboratory for the 15 months ending March 31 show a loss on the working which is largely due, as compared with previous years, to the cessation of a grant of £250 a year previously made by the Rhenish Westphalian Coal Syndicate, in consideration of the investigations of samples of coal furnished by it. An appendix to the report states the fees charged by the Laboratory for the more usual tests of gas-works' materials. These fees are, speaking generally, somewhat higher than those charged for the same work by technical chemists in practice in this country.

The instructional work of the Laboratory has been directed to the practical training of young gas engineers who have passed their college course. A number of such students have participated in the work of the Laboratory for a considerable time as voluntary assistants. The Laboratory has also collaborated with the Carlsruhe Technical College in eight-day courses of practical training for gas engineers given in connection with lectures at the College.

The report records the resignation of Herr F. Reichard, who has been a promient member of the Technical Committee of the Instructional and Experimental Works since its inception. Herr Helk, having succeeded to Herr Reichard's position at the Carlsruhe Gas-Works, has been nominated a member of the Committee. The works are under the directorship of Dr. Karl Bunte, son of Professor H. Bunte, who is a member of the Technical Committee who supervise the work of the Experimental Works.

WORKING OF GAS-WORKS.

This Committee, who were first appointed at last year's meeting of the Association, have for their object the treatment of technical works and economical questions of the gas industry. At the outset, the Committee regarded the compilation of statistics of the industry and the promulgation of a uniform scheme of book-keeping for gas undertakings as the most pressing matters. The Committee held three sittings to discuss them.

An attempt had been made to obtain fundamental figures for a compilation of gas statistics for three years ending with 1909-10, relating to all German gas-works. But the result showed that no answer could be expected from many of the small gas-works to some even of the most elementary questions. For 1909, however, statistics referring to 90 per cent. of the total make of gas, emanating from about 65 per cent. of the total number of gas-works, have been collected. The question is under consideration whether a less comprehensive series of questions should be put to all gas-works after the lapse of a few years. The annual statistics, which are collected by the German Association in regard to 287 gas-works, are, however, very valuable; and with a view to increasing their usefulness and extent, the questions on which they are based will this year be sent to all German gas-works, in the hope of eliciting replies from a greater number. The questions have been somewhat simplified by the Committee. The Central Organization for Promoting the Sale of Gas has also collected monthly data relating to the increase in the sale of gas and in the number of prepayment meters in use. These figures have been very useful to it in its work of advertising, as they indicate the new and vigorous activity of the gas industry.

In the task of evolving a scheme or uniform system of book-keeping for adoption by all gas-works, great difficulties have been encountered; and while the Committee have agreed as to the necessity for the observance of certain general rules as to the writing off of depreciation &c., by all gas-works, the differences in the working conditions in different towns of Germany have so far prevented them formulating a complete scheme. Opportunity will be taken, however, to meet these difficulties, and to bring forward as soon as may be a model scheme.

The report is signed by Herr Prenger, of Cologne, the Chairman of the Committee and President of the Association. An appendix to the report summarizes some of the statistical information collected in regard to gas supply in Germany during the year 1909.

TECHNICAL INSTRUCTION COMMITTEE.

The following is a summary of the contents of the final report of the Committee appointed by the Association to investigate and report on Technical Instruction or Training. The report, which was submitted at the recent meeting in Dresden, is signed by Herr W. von Oechelhaeuser, the Chairman of the Committee.

It is announced at the outset that it was decided, at a meeting of the Committee with the Council of the Association held last March, that, in view of the facts that the District Gas Associations have now interested themselves directly with training courses for gas-works officials and foremen, and that the Instructional and Experimental Works of the Association are collaborating with the Carlsruhe Technical College and other bodies in providing courses of lectures and training, it was undesirable that this Committee should continue in existence. Their objects would be fulfilled by the Committee for the Carlsruhe works, and a multiplication of Committees was to be deprecated. Hence the Committee have not asked for re-appointment.

The report refers to the review of the work accomplished by the Committee, as given in the memorial volume published on the occasion of the jubilee of the Association two years ago [see "JOURNAL," Vol. CVII., pp. 41, 169]. The Committee have aimed, firstly, at advancing the training of gas engineers at technical colleges and, secondly, at creating and extending opportunities for the technical instruction of gas-works foremen and gas-fitters. In regard to the training of gas engineers, three different courses are provided at the Technical College at Carlsruhe. The first is an eight-term course, comprising grounding in chemistry and instruction in mechanics, electricity, and engineering as required for the practical work of a gas engineer. It is intended for students who at the outset have decided to enter the gas industry. The second course consists of two terms only, and is intended for students who, during their general engineering training, decide to specialize in gas manufacture and lighting. The third course, held at Easter time, is of fourteen days' duration, and is intended for engineers and assistants already engaged on gas-works who desire to improve their scientific and theoretical knowledge. This course is usually attended by from 35 to 40 persons. In addition to these courses at Carlsruhe, the Instructional and Experimental Works of the Association admit a certain number of students who, having finished their course at the Technical College, desire to have the opportunity of familiarizing themselves with the latest developments in the gas industry.

The Committee have prompted and collaborated in the foundation of courses of instruction for gas-works foremen and fitters, similar to those first established at Dessau, at the following places —viz., Altenburg, Aue i.S., Bremen, Breslau, Cologne, Munich, and Nuremberg. The results have proved that there is an increasing demand for such courses; and the Committee strongly recommend the District Associations, in whose districts such courses are not already provided, to endeavour to secure their provision. They also ask gas engineers to support existing classes, and to send their more promising young workmen to attend them. So much has already been accomplished in providing opportunities for technical instruction for gas engineers and fitters, and the lines on which such instruction should be afforded have been so well established, that the Committee consider that their purpose has been accomplished, and that the Committee of the Instructional and Experimental Works can now more appropriately deal with any questions as to technical training that may arise.

In conclusion, they call attention to the deficiency continuing to exist in the supply of properly trained gas-fitters, &c., and to the danger of accidents arising from fitting work being improperly executed, and recommend the District Associations and individual gas engineers to do all in their power to rectify these evils.

Masonic.—The Provincial Grand Lodge of Lincolnshire met at Lincoln on the 6th inst., when among the past grand honours conferred was that of Past Grand Warden on W. Bro. E. J. Brockway, of Cleethorpes.

PYROMETER INSTALLATION AT THE CAMBRIDGE GAS-WORKS.

The desirability of ascertaining the working temperatures of gas-retorts has been emphasized by most up-to-date gas engineers within the past few years, and has indeed been brought forward to the front rank of interest by the recent investigations of the Refractory Materials Committee of the Institution of Gas Engineers. Hence the ingenious method lately adopted by the Cambridge Gas Company for the rapid reading of gas-retort temperatures deserves notice.

The pyrometer employed in the retort-house of this Company's works is of the well-known Féry radiation pattern, manufactured by the Cambridge Scientific Instrument Company. It was previously employed in the manner illustrated in fig. 1, where a telescope mounted on a tripod stand is sighted half-way into the

Fig. 1.—Portable Féry Radiation Pyrometer being used to take the Temperature of a Gas-Retort.

retort. Part of the heat radiating from this point strikes into the telescope, and is focussed on to a very small thermo-couple. An electro-motive force is thus generated in the couple, which causes a current to pass through and deflect a millivoltmeter connected to it. The millivoltmeter being calibrated in temperature degrees, the temperature of the retort is directly read off.

Since, however, a comparatively large number of temperature readings have to be taken each day, the new device shown in fig. 2 has been installed at the Cambridge Gas-Works so as to avoid the re-sighting of the telescope for each new reading, and to allow of rapidity in reading off the temperature of each retort as soon as it has been discharged.

An iron runner is fixed overhead, parallel to, and in front of, the series of retort-beds. From this runner a small carriage is suspended on four wheels; and from the centre of this carriage hangs a long vertical rod on a ball-support. On this vertical rod a bracket, which holds the Féry telescope, is movable to three set positions, which are marked on the rod. These three positions correspond to the three tiers of retorts. The Féry telescope is focussed once for all half-way down the length of the retorts.

The millivoltmeter is permanently fixed at one end of the retort-house in a dust-tight box (see the extreme left-hand side of fig. 2); the scale being viewed through a window in the latter, and is illuminated by an electric light placed inside the latter. Leading from this indicator a two-way cable is attached to sockets fixed at suitable distances along the length of the retort-house (one socket to each retort-bed). A plug connection completes the circuit from the Féry telescope to the millivoltmeter; this plug being moved from one socket to another as required.

Immediately the "Pusher" is moved along from a newly-discharged retort to the next retort, the vertical rod supporting the Féry telescope is drawn along in front of the first retort—the correct position being found by observing through the sight-hole. The operator then indicates that all is ready, when the temperature is read off on the millivoltmeter and noted.

Fig. 3.—The Féry Spiral Pyrometer.

The installation is extremely neat; and, due to the rapidity with which the temperatures can be taken, it has become a systematic rule at these works to register the temperatures of all the settings in action every day. A row of retorts is taken each day; so that the temperature of every retort is obtained twice a week. When the pyrometer is not in use, the telescope with its support is run back to one end of the retort-house; and, to protect it from dust, the telescope is covered by a hood.

Fig. 3 illustrates the Féry spiral pyrometer, in which instrument the temperature-scale forms part of the telescope; so that the instrument is entirely self-contained, and no connecting leads are required. This allows the same observer to sight the telescope and read the temperature. It is largely used for taking gas-retort temperatures, though for a permanent installation the outfit previously described is more suitable.

This pyrometric installation indicates the trend of the scientific

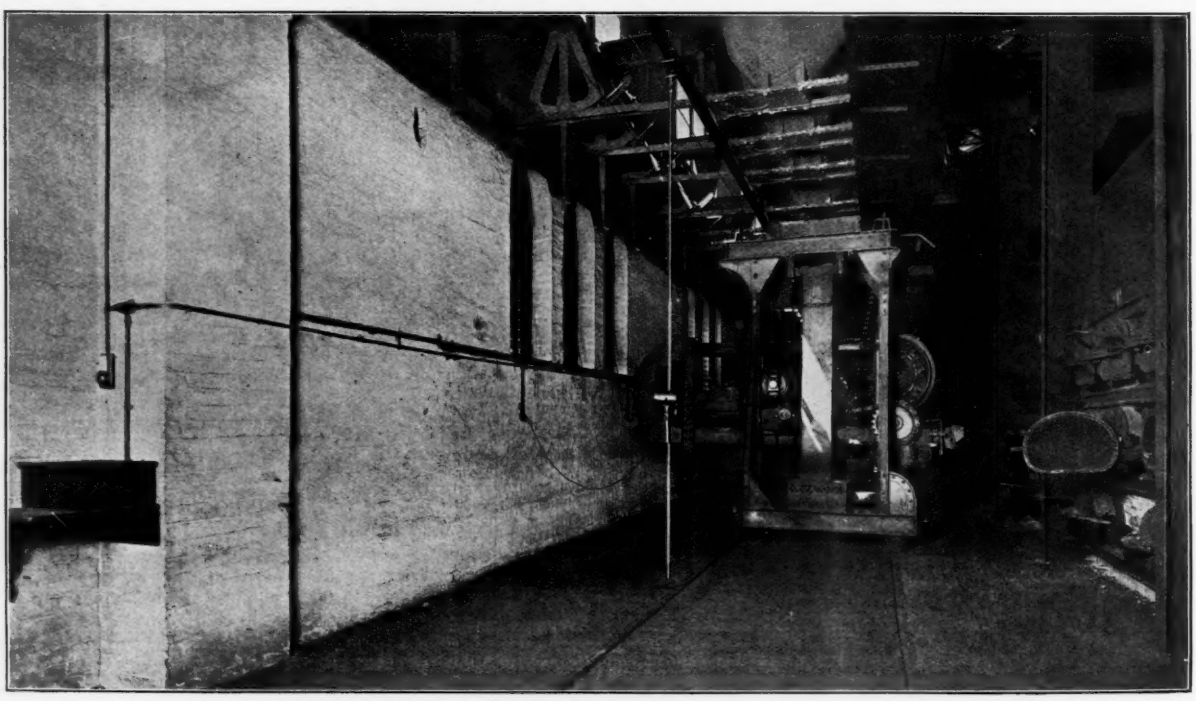
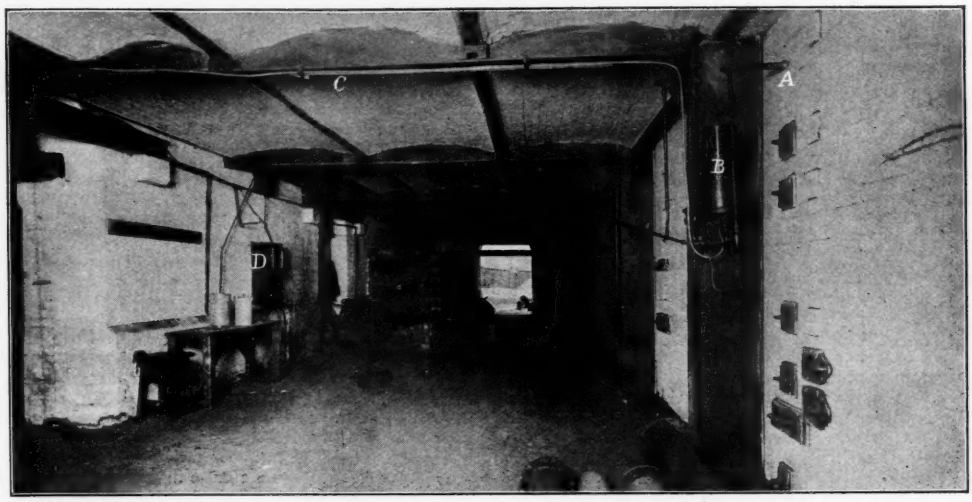


Fig. 2.—Féry Pyrometer Outfit permanently Installed at the Cambridge Gas-Works.



A—Intake Pipe from the flue. B—Soot-filter. C—Connecting piping. D—Recorder.

Fig. 4.—The "Bi-Meter CO_2 Recorder" in a Retort-House of the Cambridge Gas Company.

methods employed in the modern manufacture of gas; and it is especially to the credit of the Cambridge Gas Company that they are by no means behindhand in this movement.

Indeed, in addition to the above pyrometer, there is also installed an instrument for recording the percentage of carbon dioxide in the flue gases from the generator furnaces of one of their retort-benches. This instrument is one of the "Bi-Meter CO_2 Recorders," of which the Cambridge Scientific Instrument Company are the sole British manufacturers.

Fig. 4 is a photograph of the actual recorder below the retort-house. The connecting piping leads to the eight beds of the retort-house, and the instrument can be connected at will to analyze the gases in the generator furnaces of any of these beds.

The "Bi-Meter Recorder" has one great advantage which will appeal to all gas-works, in that the absorbent used for the carbon dioxide is ordinary slaked lime in the form of moist powder. The metal absorption chamber may be given to a labourer, who quickly learns how to refill it with slaked lime (necessary once every two days or so) after being instructed once or twice.

An actual record taken at the Cambridge Gas-Works is reproduced in fig. 5. The high percentage of carbon dioxide is interesting, as showing how perfect is the combustion in the retort-beds.

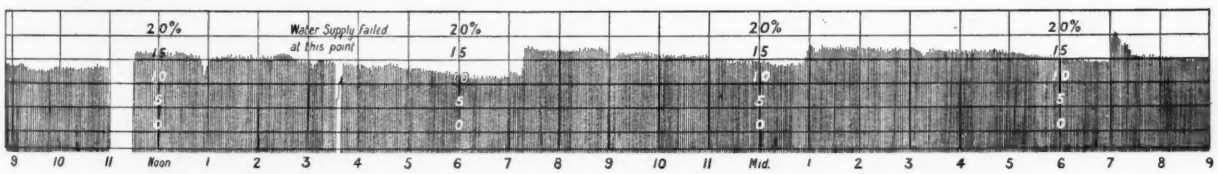


Fig. 5.—Record of Carbon Dioxide in the Flue Gases of a Retort-House of the Cambridge Gas-Works (Reproduced half-size).

CARBONIZING CONSIDERATIONS.

The Recent Vertical Retort Papers.

By T. SETTLE.

WIDER and greater interest has been raised as the result of the papers recently given on vertical retort carbonization. There is nothing complex in either data or figures set forth by the authors of the papers, yet there is a difference—as has always existed, and always will do—plainly showing that there is no standard in ideas, structural or otherwise, as applied to gas-works plants or the manufacture of gas.

Mr. Newbigging is going to put down a 4 million cubic feet vertical retort plant, where now stands a 2 million horizontal installation. Doubling the production on the same floor space is, of course, largely made up for by an increase in production of gas, ranging from 25 to 30 per cent., and, again, by the larger weight of coal carbonized per retort.

These allowances can hardly be sufficient to meet the figures for floor-space as given by Messrs. Drury and Hunt. The Sunderland bench stands on a site that is equal to 2·1 superficial feet per 1000 cubic feet of gas made—carbonizing 58½ tons of coal per 24 hours.

According to Mr. Hunt's calculations, a 250-ton plant would occupy the following minimum ground area:—

	Area Superficial Feet.
Five-metre Dessau	9,128
Woodall-Duckham	9,162
Glover-West	10,520
Horizontals	12,478

Taking as a basis the figures of production per ton given in the papers, the make per 24 hours with a 250-ton plant would be—

250-Ton Plant.	Make of Gas per 24 Hours. Cubic Feet.
Five-metre Dessau	3,149,750
Woodall-Duckham	3,169,000
Glover-West (average)	3,375,000

The above daily makes represented in superficial feet space per 1000 cubic feet made would be—

	Superficial Feet.
Five-metre Dessau	2·8
Woodall-Duckham	2·8
Glover-West	3·1

A fair basis for Mr. Hunt's 12,478 superficial feet for horizontals would be to take ten beds of horizontal retorts, 20 feet throughs (22 in. by 16 in.), carbonizing 96 tons of coal per 24 hours, at an average of 10,500 cubic feet—making 1,000,000 cubic feet per day. The space for this size of bench would be 2370 superficial feet, or 2·3 superficial feet per 1000 cubic feet of gas made—being only 0·2 per cent. less than the Sunderland figure. It becomes almost a puzzle how Mr. Newbigging is going to get 2 million cubic feet extra production of gas on only 0·8 per cent. increase of floor space, as the above figures tend to prove.

Neglecting the make per ton for the moment, the horizontal installation carbonizing 37½ tons more coal than the Sunderland bench is carried out on only 0·2 per cent. extra superficial area per 1000 cubic feet of gas made, with 1,000,000 cubic feet of gas for horizontal and 740,000 cubic feet for the Sunderland verticals in 24 hours. Mr. Hunt's figures of 12,478 cubic feet for horizontals, and 9600 cubic feet (average) for the three systems of verticals, show the latter is nearly 30 per cent. less—area for area—on gas made per 1000 cubic feet; the superficial area only varying 0·2 per cent. per 1000 cubic feet of gas made.

In regard to back-pressure in vertical retorts (charged in bulk), it has followed in all experiences, as in Mr. Drury's case—there has been a back-pressure ranging from 25-10ths to 75-10ths at the bottom of the retort, when first charged.

	Tenths.	
Dr. Bueb (1906), Dessau, gave	45	Maximum Pressure.
Settle-Padfield (1903), Exeter, gave	75	
C. Dru Drury (1911), Sunderland, gave	65	

A writer asks in the "JOURNAL" for the 4th inst. (p. 33): "Is it not possible to provide a gas-outlet at the bottom of the (Dessau) retort, even at the expense of some structural difficulties?" It will have occurred to those having experience with continuous carbonizing processes with vertical retorts, that the provision of an outlet at the lower mouthpiece would be going back to unscien-

tific carbonization—the same as in the case of the ascension pipe being on the bottom mouthpiece of an inclined retort.

The results attending vertical retort carbonization compare favourably in volume and illuminating power obtained, as follows—

	System.	Make Per Ton. Cubic Feet.	Candle Power.	
Sunderland (1911)	Dessau	12,647	15·52	Averages
Manchester (1911)	Glover-West	13,500	15·37	
Lausanne (1911)	Woodall-Duckham	12,676	—	
Exeter (1903)	Settle-Padfield	13,189	14·56	

(Exeter—Average from eleven different kinds of coal.)

Steaming the charge appears to be done only with the Dessau system; and, for this is claimed an extra 1000 cubic feet of gas per ton, with a loss on the bulk volume obtained of 0·37 candle in illuminating power. Practically, these results are confirmed at Dessau (1906) and Exeter (1904).

The Dessau system appears to stand alone in the claim that the "core" of the charge is the passage of least resistance for the travel of the gas evolved; and opinions expressed by Dr. Bueb (1906) and the writer (1903) are now fully confirmed by Mr. Drury, who finds "fissures" in the spent charges, in the same way as hollow diameters were found in the coke at Exeter when experimenting with whole charges dumped into the retort.

Mr. Drury's figures of the temperature of the gas leaving vertical and horizontal retorts at set points are given below, with some temperatures added as obtained at Exeter.

	Sunderland. Verticals. Deg. Fahr.	Sunderland. Horizontal. Deg. Fahr.	Exeter. Verticals. Deg. Fahr.	
Retort-lid	815	939	460	Averages.
Bridge-pipe	220	195	320	
Outlet of hydraulic main	140	130	155	

Very little importance can be attached to temperatures, in the many recorded, in horizontal practice taken at the points given, as these vary to the extent of 66 per cent., as the different text-books will show. The average hourly temperature of the gas evolved is important, in indicating that the gas when made is being subjected to a low, yet uniform, heat in its passage from the vertical retort. It will be seen from the following figures that the same regularity of temperature does not exist in the Dessau system, as compared with a continuous system of charging.

Hour.	Sunderland. C. Dru Drury. 1911. Retort-Lid. Deg. Fahr.	Sunderland. C. Dru Drury. 1911. Bridge Pipe. Deg. Fahr.	Dessau. Dr. Bueb. 1906. Hydraulic Main. Deg. Fahr.	Dessau. Dr. Bueb. 1906. Retort-Lid. Deg. Fahr.	Exeter. T. Settle. 1903. Mouthpiece. Deg. Fahr.	Exeter. T. Settle. 1903. Hydraulic Main. Deg. Fahr.
1	568	238	157	374	380	155
2	727	252	158	590	370	135
3	750	262	149	599	368	130
4	766	274	136	504	360	130
5	753	264	135	422	355	128
6	775	268	128	419	342	125
7	792	266	133	415		
8	780	254	150	410		
9	776	243	143	401		
10	767	235	132	338		
11 Steaming	780	245	135			
12 ,,	744	229	129			

It will be noticed that in Mr. Drury's figures there is a rise of temperature of the gas evolved from the first to the seventh hour; and in Dr. Bueb's results (1906) the temperature reaches its maximum at the end of the third hour. In the Dessau results of temperatures of gas, one point is marked with interest, in that it was not until the fourth hour after charging that the temperature of the centre of the charge exceeded the temperature of the gas evolved—

Centre of charge	370° C.
Gas evolved	318° C.

It is something to hope for that Messrs. Newbigging, Glover, and Leather will also furnish a record of temperatures of the gas hourly, with also the make and candle power in the same period of time. With these results at hand, it will be seen what degree of uniformity is obtained, and will demonstrate that continuous carbonization is the really scientific process.

Mr. Newbigging, in his paper, gives the candle power as running for five consecutive hours; and it is almost a pity the hourly makes are not included as well. These figures may be given, with some Exeter results added—

Hour.	Droylsden. Candle Power.		Exeter. Candle Power.
1	Commencement	15·20	Average 14·65
2	,,	15·35	,, 14·63
3	,,	15·30	,, 14·50
4	,,	15·18	,, 14·50
5	,,	15·52	,, 14·63
6	,,	15·65	,, 14·63

The uniformity of the calorific value as obtained and recorded at Droylsden, shows how remarkably constant this is; and it may be expected that the candle power will run in quite a straight and uniform a line as the calorific value does.

It would serve only one purpose to champion processes obtaining the greatest regularity of action without giving the same the support it deserves by also showing other processes for which so-called advantages are claimed. We have here some results of a chamber-oven system of carbonizing coal in bulk. The following table will be of interest as indicating the fall in make and the loss in candle power as time proceeds—

Hour.	Make Per Cent.	Candle Power. Per Cent.
1	Highest 100	Highest 100
3	Dropped 30	Dropped 51
6	,, 37	,, 61
9	,, 40	,, 58
12	,, 40	,, 58
15	,, 40	,, 67·5
18	,, 52	,, 85·0
21	,, 67	,, 94
24	,, 92	,, Nil.

In the "full-up" retort practice, working results are scarce indeed. In one case, however, the candle power is given as the highest at the end of the first hour—20 candles. By the end of the fourth hour, the illuminating power has fallen 26 per cent.; and at the end of the eighth hour, 71·5 per cent. We have had it laid down hard and fast, for many years past, that the rate of production of gas from a charge in horizontal retorts is somewhat as follows, taking three different authorities:

Hour.	1. Per Cent. of Make.	2. Per Cent. of Make.	3. Per Cent. of Make.
1	52	33·4	52·0
2	34	29·5	34·5
3	12	26·7	12·0
4	2	10·4	1·5

Enough has been said, and results given, both for and against carbonizing systems at present in use; and it is still left open to decide what little remains to perfect and complete the scientific carbonization of coal—especially in these days, when high-standard illuminating powers are no longer considered. It is most appropriate, both in time and opportunity, to once again refer to the lecture given by Professor Lewes before the Irish Association, in 1904, when he told the members what he thought ideal carbonization should consist of, and concluded his lecture by saying: "It is at once evident that uniformity of action is really the key-note of success in any process of carbonization."

Serious Fire at the Bovisa Gas-Works, Milan.—We learn that on or about the 7th inst., at the new Bovisa works of the Union des Gaz Company at Milan, a fire broke out in the accumulated stocks of coke; some 5000 tons being affected. The efforts of the fire brigade were ineffective to put out the enormous mass involved, and their energies, with the assistance of some 200 labourers, were directed to cutting off, by means of a large trench, the remaining stock, the whole of which occupied an area of about 60 m. long by 20 m. wide by 10 m. high. It is said that the damage done amounts to about 300,000 lire (say, £12,000), and that the fire was not expected to burn itself out till Sunday last (the 16th inst.). There is, apparently, no ground for any suggestion that the fire was due in any way to the strike, but it may be that it was caused by inadequately quenching some of the drawn charges.

Coke-Oven Gas Proposed for Ostend.—The municipal authorities of Ostend were lately considering the question of reconstructing the gas-works, at a cost of about £100,000, when their attention was called to the use which has been made in Germany and the United States of coke-oven gas for light and power. According to "The Times," they have decided to demolish the existing works, and invite tenders for the supply of gas needed for a period of 26 years, about 212 million cubic feet per annum to start with, together with a supply of electricity. As no coke-ovens at present exist in the vicinity of the town, they will have to be erected by the contractors. For this purpose, the municipal authorities are prepared to let at a small rental a piece of land having an area of about 12 acres, with a frontage 900 feet long to a canal 20 feet deep, and connected with the railways, docks, and harbour.

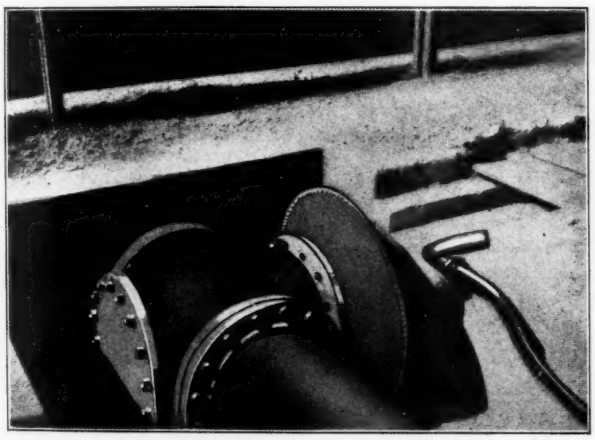
Gas Companies' Accounts for 1910.—We have received from Messrs. John Allan and Co. the "Gas World Analyses of Gas Companies' Accounts for 1910." The accounts of 54 gas companies, with makes ranging from 47 million up to 27,000 million cubic feet, are analyzed; all the items of revenue and expenditure being worked out at per 1000 cubic feet of gas sold, and the results set out on two large linen-backed sheets. On the left-hand one will be found particulars relating to the coal carbonized, the percentage of carburetted water gas produced, the quantity of gas made, sold, and unaccounted for, the yield of residuals, statistics of revenue, &c.; while on the right-hand sheet are given the distribution and management charges, bad debts, net cost of gas, mileage of mains, number of consumers and public lamps, total capital and the capital per ton and per 1000 cubic feet, and the reserve funds. Under the heading "Distribution Details," particulars are given of the test-burner; and it is interesting to note that about half the companies use the No. 2 "Metropolitan." As in the case of the "Analyses of Municipal Gas Accounts" issued early in the year, cardboard rules are supplied to facilitate comparison with figures of any of the undertakings given. The work is similar in appearance to its predecessors, and the price is 10s. 6d. net.

GAS PLANT IN AN EARTHQUAKE.

Effects in Mexico.

THE current number of the "American Gaslight Journal" opens with a special article by Mr. Charles D. Lamson on the earthquake in Mexico, and its effects upon the manufacturing and distributing plants of the Mexican National Gas Company. It is illustrated by a number of interesting reproductions of photographs; and from the accompanying descriptive matter we take the following particulars.

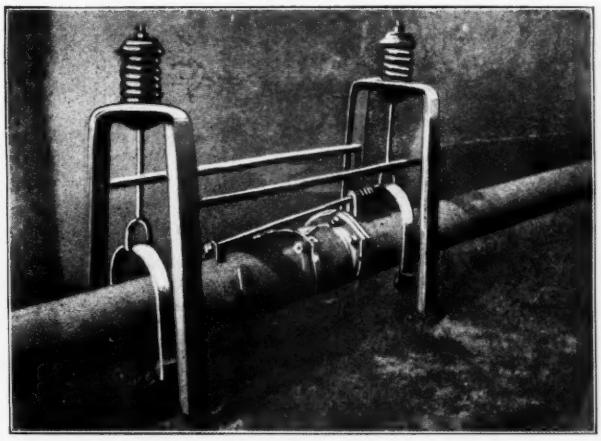
The earthquake which occurred at half-past four on the morning of the 7th of June, is described by Mr. Lamson as the most violent and terrifying one within the memory of the oldest inhabitant of the city of Mexico. This being the first earthquake of any consequence to visit the vicinity since the National Gas Company commenced operations, the works and plant were subjected to a test which the author says fully proved the value of the peculiar methods adopted in the installation of the machinery and connections and the laying of the mains, in so far as these methods were intended to withstand successfully the effects of earthquake shocks. It appears that in the works themselves the only damage done was to a 60,000 gallon water-tower, the underframing of which was badly twisted, and the tank rendered worthless for the time being by the inlet connection snapping off short at the point where it joined the conical-shaped bottom of the tank. It is considered that even this damage might have been avoided if the flexibility of the superstructure had not been destroyed through having been solidly bricked-up between the I-beam column supports, so as to form the walls of the pump-house. The pumps directly beneath the tank, and the steam and water connections thereto, were not disturbed in the least; this being due entirely to the use of full-sweep bends, and the avoidance of the use of fittings followed generally in making the steam and water pipe connections throughout the plant.



Bellows Expansion Joint to Protect Riveted Steel Pipe Lines round Works' Plant.

The main gas-piping is all of riveted steel plate, 20 and 16 inches diameter, held up by specially constructed hanger supports and roller bearings designed to take up automatically all horizontal, lateral, and perpendicular strains to which the piping, through its own gravity and the action of the spiral springs, may be subjected. Each set of apparatus, at the point of connection with the principal mains, is provided with an expansion joint, which allows the piping and apparatus to take up any motion independently of each other. Two types of expansion joint are used—one being the usual standard iron body and brass sleeve on the vertical line of pipe, and the other a wrought-iron bellows or diaphragm-shaped one, of the Company's own design and make, on the horizontal lines. Observations taken at the plant immediately after the earthquake showed the traverse made by the brass sleeves in the standard expansion joints to have varied from 2½ to 4 inches. The expansion and contraction on the other type of joint could not be determined, as, owing to its construction, it resumed its original position without leaving anything to indicate the range of variation. As the main buildings around the plant are constructed of steel, with corrugated sides and roofing, no harm was done to the structures. The lampblack separator, the filter, and the underground water storage reservoir, being all of reinforced concrete, were likewise undamaged, though the strains to which they were subjected must have been terrific. The level of the water in the reservoir was 5 feet below the top; in the filter, 4 ft. 6 in. below the overflow. From both receptacles the water was thrown out and over the walls, flooding the surrounding yard.

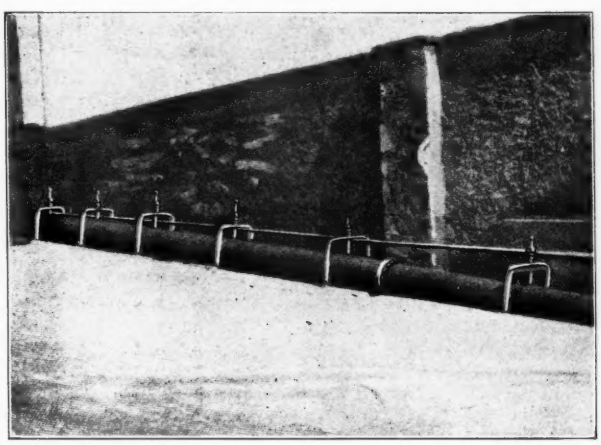
Despite the shaking up, Mr. Lamson states that at no time was the gas supply shut off from the city, although for a period the pressure was reduced until the storage holder drips could be cleared to allow the booster to get a full supply. These drips became partially sealed through the violent oscillatory motion of the water in the holder tank, which caused a slopping over into the inlet and outlet stand-pipes, and thence into the drip-pots. The normal level of the water in the gasholder tank was reduced 5 inches. As the springs behind the rollers allowed plenty of play for the holder in the guide-framing, the cups of the outer and middle lifts did not unseal.



Expansion Joint and Flexible Supports on High-Pressure Line just before same Connects with Compression Tanks. This Joint showed a Traverse of 6½ Inches.

The distributing system is a combination one of high and low pressure; the high-pressure side being of standard wrought-iron pipe, which supplies the various sections of the city through double district governors, so placed that a uniform pressure of 36-10ths on the low-pressure side is maintained. The low-pressure mains are of cast-iron pipe (class "B") with bell-and-spigot joints, in lengths of 12 feet. At the time of the earthquake, there were in use 49 miles of mains and 73 miles of service-pipe; 42 miles of the latter being through services from main to meter, and the remainder from the main to the kerb only. The distributing system covers pretty nearly the entire area affected by the earthquake; the district that was most severely shaken being completely "gridironed" with low-pressure mains, besides having the greater part of the high-pressure line and three of the district governors within its boundaries. The system followed in laying this pipe was pretty much the same as that generally followed in the United States; the essential difference being mainly in the manner of yarning and leading the pipes.

Owing to the almost level surface of the streets, and the further fact that the telephone and electric lighting systems are supplied through underground conduits, a great many drips were necessary to avoid obstructions and to give proper drainage to the pipe-lines. To avoid the dead-weight incident to using the ordinary standard drip or syphon, and to maintain the flexibility horizontally in the line, the Company use a horizontal drip consisting of a piece of pipe from 36 to 48 inches long, and from 2 to 2½ inches larger in diameter than the pipe to be drained. Thus a 4-inch main will



Flexible Hanger Supports on 20-Inch Main Pipe-Line at the Plant.

drain into a drip made of 10-inch pipe introduced into the run, and connected thereto by a 4 in. by 10 in. double bell; the bell of smaller diameter being cast eccentric to the larger one. The joints are made in the same way as the others in the line.

In running the high-pressure lines, expansion joints are used throughout—on an average about eight to a mile. They are set in masonry vaults, to facilitate regular inspection, and to allow of

repairs being made quickly. All turns in the lines are formed with long-sweep bands made of the pipe itself. An examination of these joints, made immediately after the earthquake, revealed the fact that they had drawn to the extent of 3 to 4½ inches. Subsequent examination, however, has shown that they have resumed their original positions. The services are connected to the mains by means of a T and a street elbow; the settings being so arranged as to form a swing joint. In entering the building, space is allowed for the pipe to swing where it passes through the foundation walls. The largest number of leaks after the earthquake developed in the services at the junction with the main. Here it was found that the street elbows had sheared off at the male thread, owing to the joint having been too solidly made when first installed. Several minor breaks were found in the reducing castings on the mains; but these were generally on dead-end lines, where the flexibility of the system had not been maintained owing to the absence of the connecting lines.

With this recent experience, coupled with the author's observations in earthquake countries in both hemispheres during a period extending over five years, the following deductions may, he says, be depended upon as reliable when applied to gas plant construction in localities subject to seismic disturbances:

1.—That cast-iron pipe, class "B" or heavier, with bell-and-spigot joints, securely blocked up, yarned thoroughly, and with the lead properly cast into the joints, running same from 15 to 20 per cent. heavier in weight than in the usual practice, will withstand severe shocks, lateral or perpendicular, without fracture or permanent distension, especially when the piping system is tied in on all intersections.

2.—That, in reducing the size for branch lines, it is preferable to use branch fittings of the same diameter on all outlets, effecting the required reduction at a point at least a pipe length away from the branch fitting.

3.—That is, using wrought-iron or steel screw-pipe for mains, if proper expansion joints are used, so that they will average in number eight per mile, there will be no stripping of threads or buckling or rupture of pipe.

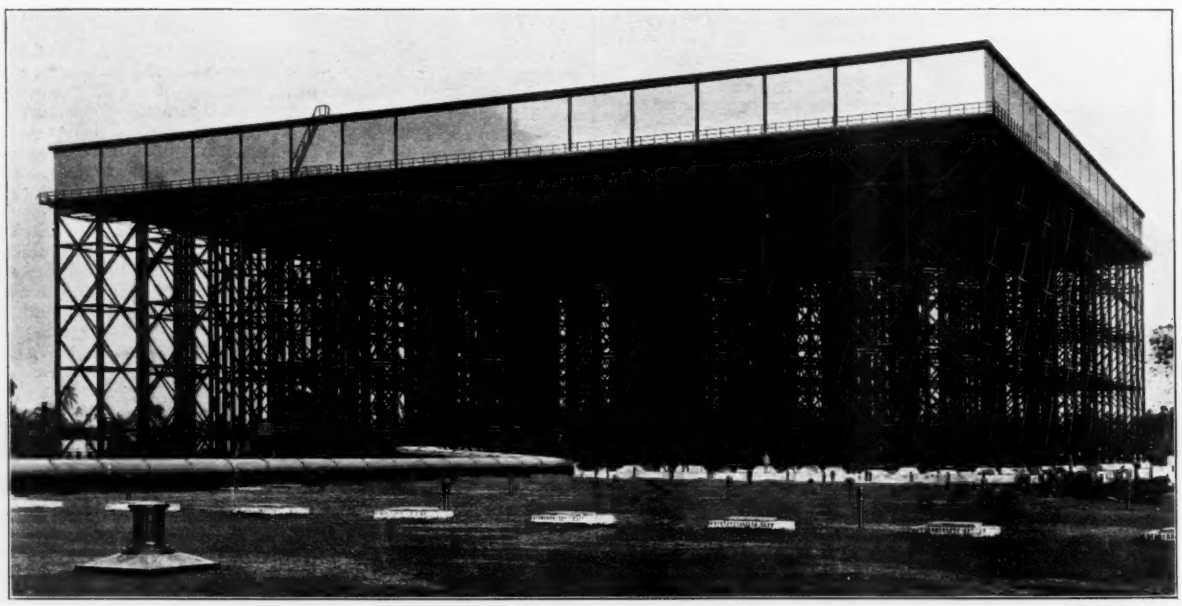
4.—That the use of cast-iron fittings in wrought-iron pipe-lines will result in the destruction of such fittings in the event of a sudden strain.

5.—That bends or off-sets, in wrought-iron or steel pipe-lines, should be of long radius, and made of the same class of pipe as that used in the line.

6.—That in running services, where these are tapped into the main, brass street elbows and service-tees, put together with graphite and oil applied to the male threads, to ensure tightness without sacrificing flexibility, are an absolute insurance against ruptured mains or sheared services.

GIGANTIC WATER-TANK IN CALCUTTA.

The Largest Elevated Reservoir in the World.



The Elevated Steel Water-Tank at Calcutta.

In the "Journal" for Jan. 26, 1909, it was announced that Messrs. Clayton, Son, and Co., Limited, of Leeds, had obtained the contract for the erection of an elevated steel water-tank, capable of holding 9 million gallons, for the Municipality of Calcutta; and in the number for the 20th of April following, some particulars were given of the structure. It was completed early in this year—three months within the specified time—and brought into use a few weeks ago, when the connection of the 6-feet mains with it was finished. We give a reproduction of a photograph of the tank, which presents some interesting constructional features.

The tank is 321 feet square and 16 feet deep, and is supported by steel stanchions; the height from the ground level to the top being 110 feet. As already mentioned, its capacity is 9 million gallons, equal to a weight of 40,000 tons; and it is divided into four compartments, each of which can be used independently of the other. The weight of steel employed in the structure is 7000 tons. The actual contract commenced with the steel shoes for the columns, which were connected one with the other by means of 6 in. by 3 in. joists. The columns consisted of broad-flanged beams, 17 in. by 12 in. They were made up in two lengths of 48 ft. 6 in. and 40 feet, and were jointed with plates on both the flanges and the web; 112 rivets being used to each joint. The bracing consisted of joist, channels, T, and flat bars, directly bolted to the columns or fixed to them with cleats. The main girders for carrying the tank consist of two steel joists, each 24 in. by 12 in. fixed at 15-inch centres to the caps of the columns, and connected on their top and bottom flanges with 6 in. by ½ in. steel straps, three to each 20-feet space. The joints in the main girders were arranged to come over the columns, and a space of ¼ inch was left between each, so as to allow for expansion. These girders were connected by joint plates measuring 17 in. by 12 in. with 1-inch bolt-holes drilled in them. The corners of the tank, including the partition corners, were braced with three horizontal gussets and horizontal ties riveted to the angles.

The tank was completely roofed in; the roof being carried on columns composed of joists 16 feet in length and 8 in. by 5 in., connected to the floor of the tank by base plates. The roof girders, which are 12 in. by 5 in., were connected to the columns by cleats; and 8 in. by 4 in. cross joists were riveted to the former. T bars 2 inches square were riveted to these joists, so as to take the roofing slates, which are 12 inches wide and ⅜ inch thick. The roof overhangs the tank by 12 inches; and the outer ends of the girders and joists are covered in with continuous plates. The under side of the overhang was also covered in either with plates or with ⅛-inch mesh brass wire gauze, so as to prevent birds, &c., from gaining access to the tank. The slates and other masonry work on the roof were not included in Messrs. Clayton's contract, which did, however, include the provision of overflow and ventilation pipes and pipes for filling the tank and drawing off the water, together with the necessary penstock chambers, valves, &c. A platform, protected by a railing, runs right round the tank at its bottom level; and staircases have been provided, so that access may be obtained to it from the ground. The insides of the four compartments can be reached through manholes.

The tank is designed to act as a balancer, and to assist the pumps when they cannot send sufficient water into the mains to

meet the demand. In a tropical city like Calcutta, there is naturally very considerable fluctuation between the minimum and maximum demand—varying from 7·5 gallons per head of the population at night to 75 gallons during the hours of maximum demand in the daytime; and the system of pumping direct into the mains is not elastic enough to meet this requirement. This is where the utility of a tank comes in. During the night hours, when the pumps are providing more water than is needed, the excess quantity will go into the tank as a reserve. Then when the great demand comes, and the main cannot be kept full by the pumps, the reserve supply from the tank comes into operation automatically, and thus keeps up the high-pressure supply. When the demand which the pumps cannot meet relapses, the full pressure from the pumps into the main automatically cuts off the flow from the tank; but it comes into operation again immediately the pumps are not keeping the main full.

The tank was to be made absolutely water-tight; and this we find, from a letter, which was at the same time the certificate of completion, written to Messrs. Clayton by Mr. W. B. MacCabe, M.Inst.C.E., the Chief Engineer to the Calcutta Corporation, to whose designs the tank was constructed, was most successfully accomplished. In the course of this letter, Mr. MacCabe said:

> I have to express to you my high appreciation of the manner in which the work was carried out, as I am absolutely satisfied, from constant and close inspection of the work during its progress, that there is not the smallest item in the whole of this large structure which is not first class; and I am satisfied that no firm in the world could have put better material or workmanship into the job. I have also to express my thanks to your firm for the generous and willing spirit in which you met every suggestion for the improvement of the work made by me in course of erection.

Mr. MacCabe also expresses his admiration of the way in which Messrs. Clayton's staff kept to their work all through the job, under very trying circumstances, during tropical hot weather and a rainy season. He says they carried out their duties to his entire satisfaction, and handled the Indian artisans and labourers with the utmost tact and discretion, and without any of the friction which might easily have arisen had less tact been displayed. He is satisfied that in the elevated reservoir the Calcutta Corporation have a first-class job, and one which is a credit to all connected with it.

Messrs. Clayton are to be heartily congratulated upon the successful issue of this large contract, which, it should be mentioned, was taken by them in the face of international competition.

EXPERIENCES WITH DISTANCE IGNITION OF PUBLIC LAMPS.

By H. Metzger, of Bromberg.

[Abstract Translation of a Paper read before the Meeting of the German Gas Association.]

The management of the Bromberg Gas-Works has for seven years been making trials, which concluded about a year ago, on distance igniters. In the result, all the public lamps have been equipped with them; and they have given satisfaction.

The district lighted comprises a population of about 80,000, but is more extended than that of most towns of that number of inhabitants. Some of the lamps are on high ground—130 feet above the level of the gas-works. West to east as the crow flies, the lamps extend for a distance of nearly 4 miles, and north to south for 2·8 miles. An extension of the district, which will give an extreme length of 4·7 miles, is contemplated. The gas-works are approximately in the centre of the district. In the central part, the mains are of sufficiently large size, but in the outskirts many are too narrow, though the new mains in the suburbs which are supplied from them are large enough. The pressure in the daytime is from 20-10ths to 22-10ths, and is increased in the evening to 31½-10ths to 35½-10ths. This increase is needed to maintain a sufficient pressure of supply with the inadequate mains. Until a short time previously, naphthalene washers were not used, and as a result great trouble arose through naphthalene stoppages. As thorough removal as possible of naphthalene from the gas is essential for distance ignition, because deposits of naphthalene in the mains seriously affect the working of the apparatus.

Bromberg, before distance ignition was adopted, had about 1470 public lamps, for which a staff of 22 attendants with a foreman was maintained. These men cleaned the lanterns and renewed mantles in the daytime, and lighted the lamps in the evening and extinguished them at night. They had plenty to do; and it is not pretended that the work was done as well as it might have been had greater expense been incurred. Each attendant looked after about 60 lamps, and was paid £4 10s. a month. The wages per lamp amounted to 19s. 6d. per annum. From the social standpoint, the system was bad, as the attendants' time was so broken up that they could scarcely spend any of it at home.

At first, 130 lamps in a street were fitted with distance lighters. A small trial such as this is, however, misleading, as it discloses all the faults of the system, while admitting of practically no saving of attendance. Many towns made similar trials; but comparatively few have adopted distance igniters exclusively. Trials also have been made with igniting clocks; but in the Bromberg climate they have not answered well. Repairs were very numerous, and the regulation or setting of the clocks was a tedious operation. Possibly they have since been improved; but anyhow they require more skilled attention than the ordinary lamp cleaner could give. The first trial of distance igniters at Bromberg, made with the "Bamag" apparatus, was discontinued after a time. As already indicated, in a preliminary trial of this kind, faults become conspicuous, and the necessary organization for dealing with them is lacking. Moreover, at Bromberg, in this first trial, the lamp attendants were entrusted with the care of the new igniters; and naturally they were not disposed to regard or treat too favourably a novelty which would lead to their services being dispensed with. In this trial, complaints of the high-pressure wave were received from consumers, and the number of failures to act were disproportionately high. The pressure, at ignition and extinction, often rose so considerably that even the mantles were lifted from their props; and props of special design with closed tops had to be introduced. The necessity for the high pressure was caused by want of proper adjustment of the apparatus; and the frequency of the failures was due to faulty manipulation. This naturally was only discovered later. That, in face of this experience, it was subsequently decided to introduce distance igniters again must be ascribed to the energy of those interested in the systems and to their readiness to guarantee satisfactory results. Two systems have since been adopted; the apparatus having generally been so distributed that the whole of one side of any street would be on the same system. The apparatus was put in on the conditions: (1) That it would work with a difference of pressure of 6-10ths, measured at the lamp; (2) that the lamps would be reinstated in their former condition and the town indemnified in the event of a greater difference of pressure being required, or of the number of failures exceeding 1 per cent., or of more than four cleaners and two controllers being necessary for 800 lamps; (3) any faults to be rectified free of charge in the first two years; and (4) apparatus to be put in order for a payment of 9½d. each, if sent to the makers during a period of five years. It was further arranged that the apparatus should be paid for in four annual instalments. The liability incurred in these conditions appeared to be so small that the town decided to make the necessary capital expenditure of £1750 to £2000 for the whole equipment.

Distance lighters are not yet perfect, and a long time will no doubt elapse before everyone will accept them as a matter of course. The advantages and disadvantages of any novelty have to be set one against the other; and the author holds the view that in distance lighters advantages preponderate, and that there is no sufficient reason why they should not be adopted. The disadvantages will differ with local conditions. As to the advantages, one cleaner can by daytime keep 200 lanterns clean, and only one controller is needed for 400 lamps. The wages amount to 7s. 6d. a lamp per annum, as against 19s. 6d. previously. For 1600 lamps there would be a saving of £960 in wages. The controllers are provided with bicycles; and they have to replace mantles and chimneys according to the reports of the cleaners, whose work they supervise, and to adjust as required and keep in order the igniting apparatus. After the pressure has been put on, they go through their district to rectify and note any failures. At midnight, when a number of lamps are extinguished, they do not make a similar round, because a failure then would not be of great importance. They make a second round at dawn, when the rest of the lamps are extinguished. The cleaners have thus only regular daytime work, while the controller's work is not so trying as that of the former lamp attendants. The ladders used by the cleaners have a detachable plank tread, as the ordinary rungs proved very trying as treads to men who were on them practically all their working hours.

An advantage of distance lighting is that the lighting and extinguishing may be accommodated to the brightness of the evening and morning of the particular day, while the lamps are only lighted a few minutes before the proper time; whereas the lamplighter formerly had to light those situated at the beginning of his round at least half-an-hour before that time. There is thus a saving of gas. As to the faults of the system, the allowance of 1 per cent. of failures is interpreted to mean that of 100 lamps one may fail to ignite and one fail to go out in the succeeding extinction. Thus with 1500 lamps there might all told be thirty failures in the twenty-four hours. The failures have been recorded and plotted on a diagram, from which it appears that they are gradually diminishing. The number is greater in the winter than in the summer months; but the average is well below the percentage named in the contracts. The records of failures are kept so that it may be readily seen if failure repeatedly occurs with the same lamp, in which case the igniting apparatus is overhauled, or to a series of adjacent lamps, in which case insufficient pressure and perhaps a fault in the mains may be suspected. Close observation of failures has thus assisted in bringing about a reduction of their number.

In fitting the apparatus, careful adjustment to the pressure prevailing at the spot is essential. Frequently this adjustment is not successful at the first attempt, and repeated adjustments may result in a considerable waste of mantles, the cost of which is properly chargeable to the expenses of installation of the distance lighting system. The observations of pressure in all the mains of the district are useful in detecting cases of inadequate pressure in consumer's supplies, which is an indirect but real advantage of the provision of distance igniters in a town. Faulty supplies have been located and rectified through the introduction of the distance

lighting system. The use of the latter, however, precludes the changing of the gas pressure at random, and this may at times be troublesome to the gas-works; but it is an advantage to the consumer to have his supply maintained constantly at about the same pressure. On the other hand, suburbs have bargained for lamps which may be extinguished at eleven o'clock instead of midnight, and for no all-night lamps in the summer months. It would be possible to adapt the distance lighting apparatus and the mode of using it to meet these conditions as well as those prevailing in the central districts on the same system of mains; but, on the whole, it has been found most convenient to give these suburbs the extra lighting which was not stipulated for in their contracts. This is mentioned merely to indicate conditions which may be involved in the introduction of distance lighting. It may occasionally occur that particular lamps or those in a certain district are extinguished through an unintentional wave of pressure reaching them. The probable cause has not been certainly established; but the number of such cases is decreasing. Most of them have occurred in the winter months, and have coincided with the hour for cooking the breakfast.

The pressure wave should last for five minutes, as the apparatus is more sensitive on some than on other lamps. It can be observed that the lamps light up spasmodically and not in series according to their distance from the gas-works. Particular lamps in a district where others have lighted remain unlighted until near the end of the period of increased pressure. At first, the wave was given at dusk about the same time that shop-windows were being lit up. This proved to be a mistake, and conduced to more failures. Now the wave is given five to ten minutes before the heavy evening consumption is beginning. The extra amount of gas thereby consumed is not comparable with that due to the lamplighter's early commencement of his round.

The apparatus used in Bromberg is of two kinds—the "Bamag" and the "Meteor." Although both have been used together, the author cannot express a preference. They seem equally good; some will prefer the construction of the one, some that of the other. The casing of the "Bamag" apparatus is all but indestructible; and the adjustment to the local pressure can be made very simply. The "Meteor" responds to a smaller pressure. The curves of the failures with the two types of apparatus are, however, almost exactly parallel, indicating that the failures were not for the most part caused by the apparatus, but by faulty imposition of the pressure.

The points on which the decision of a gas-works management will really rest in regard to the installation of distance lighters will, however, be: (1) Economy of wages, (2) saving of gas, (3) economy of mantles and glass chimneys, and (4) saving in respect of broken panes of glass in lanterns, and of lamplighters' equipment.

The economy of wages at Bromberg has amounted to at least 12s. per lamp per annum. This assumes that each cleaner attends to only 200 lanterns, whereas in some towns one man cleans 300 lanterns. Where pensions are given, the reduction of the staff involves a corresponding reduction in the charge on the pension fund. The saving of gas due to rapid ignition and extinction is less well established. The difference will be the smaller the better organized was the old lamp-lighting system, and obviously it will not be the same in all towns. The igniting jet or pilot-flame which is kept burning continuously is sometimes regarded as a special charge against distance ignition; but most towns have in any case adopted it irrespective of the use of a distance lighting system. Some authorities have reported a reduction in the consumption of mantles and chimneys consequent on the introduction of distance igniters; but in the author's experience, there has been an increase. It may be that this is really accounted for by better supervision leading to more frequent renewal of mantles, and is not really due to distance ignition. However it may be, a distinct saving in mantles cannot be counted upon. In regard to broken panes and lamplighters' equipment, it has been found that expenses have been reduced by about 1s. per lantern.

The author's experience indicates an annual saving of 13s. per lamp. Against this have to be set the charges for interest, depreciation, and maintenance of the distance lighters. These will be amply covered by 15 per cent., which gives 3s. 9d. The controllers for 1600 lamps require four bicycles, which could be obtained on the hire system for £20 per annum, which represents 3d. per lamp. The total charges therefore are 4s. per lamp per annum, making a net saving of 9s. With 1600 lamps, this gives a yearly economy of £720.

The author has endeavoured in this calculation not to favour the distance lighting system. Even if it showed no saving, however, he would prefer it on the score of its independence of a large staff of attendants, and its other advantages. In small towns, having only 50 to 200 public lamps, the night watchman frequently is responsible for lighting, extinguishing, and cleaning them. In such cases the service is apt to be faultily carried out, and distance-ignition is imperatively called for, though no distinct saving will be realized. It is quite true that distance lighting and extinguishing apparatus is not yet perfect; but the author does not consider that the gas manager should wait until the perfect apparatus has been devised. Advantages already obtainable are thereby foregone, and an allowance of 15 per cent. for interest and depreciation charges will admit of existing apparatus being replaced by something better after the lapse of a reasonable term.

Note by Herr Kobbert (Manager of the Konigsberg Gas-Works).

In this author's experience, the organization of the ordinary lamp-lighting staff is troublesome, owing to the restlessness of the men due to the varying times of work. Hence it is desirable to reduce it as far as possible by replacing manual attendance by mechanical control. There are available for the latter purpose: (1) Electrical and pneumatic lighters and extinguishers, (2) igniting clocks, and (3) pressure distance lighters.

The first class entails connections with the lamps, which are exposed to liability to injury, and involve much expense in supervision and maintenance. The first cost of the installation is high. These systems are more applicable to certain descriptions of private lighting. The second class—viz., lighting clocks—has been extensively tried. In Königsberg, it was first tested about ten years ago. Its faults are the sensitiveness of the clockwork to changes of temperature, and the want of punctuality in lighting lamps which should be lighted simultaneously. Improvements have since been effected which appear to dispose of these objections. Though rather dear, the clocks effect economies which allow of their cost being quickly written off. An advantage possessed by them is independence of the distributing arrangements, and they do not affect private consumers at all. A disadvantage is that they do not adapt themselves to the actual conditions of light and darkness, but work according to a fixed calendar. The necessary regulation of the clocks prevents one man attending to more than 250 lanterns. The life of the clocks has not been certainly established.

The third class of apparatus—that which operates through a wave of pressure in the distributing system—is most commonly constructed with a diaphragm. The cost is 20 to 30 per cent. lower than that of clocks, and it may be written off in about two years through the economies effected. Nothing definite can yet be said as to the durability of the membrane of the diaphragms; but the life may be provisionally reckoned at about ten years. The cost of renewal of this or other parts of the apparatus is not, however, serious. The introduction of distance pressure lighters must be preceded by exhaustive investigation of the distributing system. Pressure records must be taken by recording gauges at different places, and trial lighting appliances should be fixed at spots where the pressure differs most from the mean, and where the variations are greatest. The necessary sensitiveness for the apparatus and the increase of pressure for operating the system, can be determined from the observations thus made.

It may be best to equip a few bad sections with lighting clocks. The pressure wave is noticeable by consumers, and serves as a useful check on the proper regulation of their own incandescent burners. The wave of pressure will do no harm if the burner is properly regulated; there will be a slight roaring and a moderate brightening of the light and that is all. Wet meters and governors must, however, have the water-overflow closed in to prevent any escape of gas. The pressure-wave must be given shortly before the increased evening consumption comes on. It should last for two to three minutes. By extending it, the increase of pressure required is reduced. Each apparatus should have a lever so that it may, when necessary, be operated by a crook from the ground. A cyclist can supervise from 250 to 400 lamps. The simultaneous lighting and extinguishing of the street-lamps renders it possible to ascertain—for the first time—approximately correctly the consumption of gas for public lighting. The unaccounted-for gas also is more correctly determined. There is considerable economy in lantern-panes, chimneys, and mantles.

The systems used in Königsberg, apart from a few trial installations, have been the "Bamag" and the "Meteor;" and both have answered well. With the latter, the igniting jet is extinguished while the lamp is alight, and the apparatus does not act a second time until after the pressure has been reduced, as it naturally is in ordinary use. There is thus a certain protection afforded against unintentional operating of the apparatus by vibration, &c. In small towns, where the night watchman relieves the gas-works of the duty of lighting and extinguishing the street lamps, distance ignition does not present any considerable economical advantages. Distance lighters also do not answer well in cases where the pressure is controlled from several gas-works. Gas undertakings with a central gas-works and a good distributing system are in the best position to reap the full advantages, direct and indirect, of pressure distance ignition of public lamps.

End of the Milan Gas Strike.—The Milanese newspapers have been following in minute detail, day by day, the progress of the strike of the employees of the Compagnie L'Union des Gaz at Milan. They were able to announce on the 3rd inst. that the conflict had been happily terminated on the previous day. After protracted negotiations, an agreement was arrived at between the parties, and was put into writing and signed by the men's representatives and by the Manager (Sig. Grüss) on the 2nd inst. In substance, its terms were that the strikers were to resume work, but that ten of their number were at once to withdraw and to receive an agreed sum in compensation. The Company were not to proceed with any more dismissals until certain arrangements had been made. The question of the right of the Company to have dismissed on June 10 the 99 men (which gave rise to the strike) was to be submitted to arbitration. Each employee is in future to deposit security with the Company of 50 lire, as a guarantee against unjustifiable cessation of work, which sum, in such an eventuality, will be absolutely forfeited. Interest at 4 per cent. will be paid annually on such sums. After a banquet to the English and German substitutes who worked during the strike, they left Milan, and the strikers resumed work.

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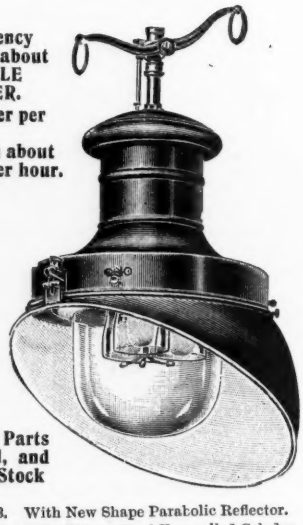

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NOTES ON STREET LIGHTING, FROM A PRACTICAL POINT OF VIEW.

By H. E. Copp, Gas Engineer to the West Bromwich Corporation.

[A Paper presented at the Annual Meeting of the Institution of Municipal and County Engineers.]

The subject, at any rate as regards the first portion of its title, is doubtless a somewhat hackneyed one. Of recent years there have been numberless communications to the press and to technical societies dealing with street lighting. They are for the most part written for the purpose of advocating one or another particular form of illumination in which the writer is more especially interested. In the present instance, however, the author proposes to set out in plain language, and with the avoidance of all technicalities and refinements of doubtful utility, a few points which have come under his personal notice, in the hope that some of the members who are responsible for public lighting in the towns they represent may find some further points of interest in the subject, the importance of which deserves more critical consideration than it has hitherto been accorded. The fact that in most of the towns no standard of lighting is recognized—some spots being lighted most extravagantly, and others left in almost complete darkness (a remark applying in some cases to whole districts)—is in itself a sufficient justification for bringing the matter to the further notice of members of the Institution. The author would, therefore, endeavour to present in an impartial manner a general review of the subject in its present state of development.

The communications referred to, which have for their sole object the advertisement of one particular system of lighting, seldom have any technical value, as it requires an expert to discriminate between truth and fiction. Only recently a technical journal devoted a whole issue to a studied rodomontade on the subject of its rival illuminant for street lighting purposes, which contained many misrepresentations and photographs of street lighting, which could only serve to illustrate the skill and patience of the photographer. Indeed, a reader without technical knowledge would at least expect the condemned system to be supplanted forthwith. Such methods cannot be regarded seriously, and do little or nothing to advance knowledge of the subject under consideration. On the other hand, a paper was read before the Institution of Gas Engineers in June last year by Mr. Jacques Abady, of London, which treats of the subject of public lighting by both gas and electricity in a most able and impartial manner, and must have exercised a sobering influence on partisans of both systems.*

The standard of lighting must necessarily vary in different towns. It would be absurd to adopt the same standard of lighting, say in some parts of London, where public thoroughfares are congested with heavy traffic, as in a small country town. It must be borne in mind, however, that two kinds of lighting are required —the one strictly utilitarian, and the other extravagant, such as would be deemed necessary for certain localities and places of resort as a species of advertisement in seaside towns, watering-places, and the like. In the present instance, however, the author proposes to deal more particularly with the former phase of the question, from which it would seem that the standard to be adopted in any town or locality should bear some relationship to its rateable value per head of the population.

A keen competition is at present in progress in London between gas and electricity for public lighting, which can only result in great improvements in the application of both systems of lighting, but probably at considerable cost to the community, as a standard of lighting is being established which in some cases exceeds the public requirements. An instance of this will be found in the lighting of Victoria Street, Westminster, which is lighted by high-pressure gas, the average illuminating power of the lamps being 3274 candles; while in other places lavish grouping of flame arc lamps will be found. In Marylebone, there is an example of what can be done, on a more moderate scale, with metallic filament lamps—there being over 2000 in use. But in spite of this competition, it is certain both gas and electricity will continue to be used for street lighting for many years to come, and advances of one system will be met by corresponding advances of its rival. It is well known that in Germany great progress has been made in the science of public lighting in recent years, and perhaps a higher standard has been established in Berlin than in any other city. But notwithstanding the enormous increase in the uses of electricity, the municipal authority is annually spending more than £50,000 on the improvement of its public lighting by gas alone.

The essential conditions for satisfactory street lighting are: (1) Even illumination of the ground, or objects near the ground; (2) uniformity of colour; (3) absence of glare. In order to fulfil the first condition, the lights must be placed at a height above the pavement corresponding with their power and spacing. A great objection to large units of light is that they must be fixed so high above the pavement that the light shines directly in the first floor windows. As regards the second condition, looking along a street there is nothing more distressing to the eye than a marked diversity in the colour of lights in a business thoroughfare. Such diversity would constitute a positive disadvantage to shopkeepers, as it would nullify to some extent their own efforts in this direction. With regard to the third condition, it is to be regretted that "glare" is often preferred to good illumination, and, indeed, is regarded by the average individual as such. Ideal street illumination would be by reflected light only, with the source of light invisible to the eye; in practice, however, such a system would be prohibitively costly. But every one knows how much better an object may be viewed when looking away from the sun than when looking towards it. The spectacular effect of a theatrical scene would be ruined were not the lights carefully screened from the eyes of the audience.

* See "Journal," Vol. CX., p. 795.

Spacing of Lamps.

In modernizing the lighting of a district, and having decided on the power of the lamps to be installed, the better plan is to re-arrange the spacing of the lamp-posts. On account of the low first cost, however, there is a strong temptation to fix two or three burners in the lanterns instead. This is usually an unsatisfactory arrangement, as the lamp-posts will probably be too low for the proper distribution of light. "The greater the candle power of the lamp, the higher it should be placed," may be regarded as a general axiom. For instance, if the low standard of a minimum illumination of 0·1 candle-foot were required, and the lamps were 50 yards apart and 12 feet high, a unit of no less than 1850-candle power would be necessary, whereas if the lamps were 20 feet high only 1200-candle power would suffice. On the other hand, if the lamp-posts were 30 yards apart, 400-candle power would be required if fixed at a height of 12 feet, and 300-candle power if 20 feet. In other words, for even distribution of light, the rays from two adjacent lamps should intersect at the ground level when about 15° below the horizontal. If this rule is followed, contrasts in the degree of lighting, which are such a source of danger to traffic, will be avoided, and there will be a minimum waste of light and a maximum of efficiency. In rural districts, the angle may be reduced to 10° below the horizontal.

The following is a portion of a table given by Mr. Abady in his paper, to which reference has already been made; and it will be found to be an extremely useful guide:—

Height of Lamp. Feet.	Distance Apart 10° Intersecting.	Distance Apart 15° Intersecting.
12	136	90
15	170	112
20	227	150

It may be here mentioned that centre lighting is generally regarded as preferable to side lighting; but this system can only be utilized in comparatively narrow streets. An experimental installation will be found in Cannon Street, London. Apparatus for suspending both gas and electric lamps centrally is manufactured by the London Electric Firm, of Croydon.

Choice of Lights—Upright *v.* Inverted Burners.

During the past three years, the inverted burner has largely supplanted the upright burner for street lighting. The reason for this is that the former gives a much higher efficiency than the latter, and is less costly in maintenance. The upright burner gives its maximum light at an angle between 15° and 20° above the horizontal; whereas the inverted burner gives its maximum light at about 45° below the horizontal. The chief reason for the greater efficiency of the latter is that the burner is to some extent regenerative; the injected air and gas being more or less heated before reaching the point of combustion. This increased efficiency will more than compensate for the proportion of light lost through being emitted in the wrong direction. The author has designed a lamp in which an attempt is made to utilize the misdirected rays from an inverted burner, and redirect them where they are required —*i.e.*, along the road about 15° below the horizontal. A sectional drawing of the lamp is shown in fig. 1, and polar curves of the lighting effects under different conditions are given in fig. 2. It will be seen that the burner used throughout the tests was not a particularly efficient one, but the comparative values of the tests are not thereby vitiated. The chief features of the lamps are as follows: (1) The top of the lamp is hinged; and it can be swung

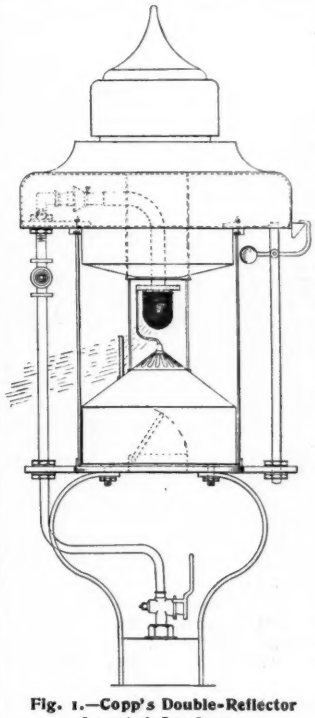
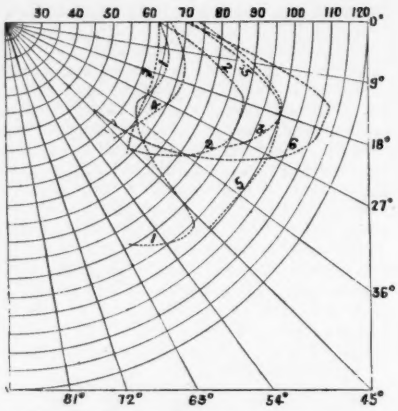


Fig. 1.—Copp's Double-Reflector Inverted Gas-Lamp.

back to facilitate cleaning. (2) Reflectors are fitted at the top and bottom of the lamp, in both of which a reflection of the mantle can be observed if viewed at an angle of 15° below the horizontal. (3) The burner is attached to the top of the lamp, and is consequently removed with it, whereas the mantle is protected from wind while the inner and outer glasses are cleaned in turn. It will be noticed that there is no circulation of air between the inner and outer glasses, so that the annular space is practically dust-proof—a feature which is utilized in a manner which is described hereafter.

Reflectors.

Electric lamps possess the great advantage over gas that reflectors of almost any type can be utilized. Holophane globes have long been used in connection with the former, but are generally inapplicable to the latter. These globes consist of a series of glass prisms for the purpose of refracting and distributing the light. Mr. Abady found that the "Excello" flame arc lamp, which is fitted with dioptric globe, gave an almost ideal curve of



Curve 1.—Top reflector only, bottom of lamp removed.
" 2.—Lamp complete, with both reflectors blackened.
" 3.—Same as No. 2, but with prismatic glass plate at bottom.
" 4.—Both reflectors blackened, with outer cylinder removed.
" 5.—Lamp complete, and both reflectors bright.
" 6.—Same as No. 5, but with prismatic glass plate at bottom.
" 7.—Parkinson's one-light street-lamp.

[The same burner and pressure were used in each test.]

Fig. 2.—Candle-Power Curves from Copp's Lamp.

illumination; and it occurred to the author to introduce a plate of prismatic glass between the inner and outer glass cylinders of the gas-lamp previously referred to, for the purpose of refracting the rays of light from the bottom of the mantle in the desired direction. A reference to fig. 2, curve No. 6, plainly shows the advantage obtained by this simple arrangement. It can only be applied, however, where the refractor is absolutely protected from dust. The top reflectors of a lamp fitted with inverted burners should always be conical or convexed in shape. Some manufacturers have made the error of adopting a concave reflector.

Public Lighting in West Bromwich.

Although West Bromwich cannot be considered a criterion as regards public lighting (the cost of which is borne chiefly by the Gas Department, the gas being charged at considerably less than cost price), nevertheless examples of almost every modern system will be found in the town. Experiments with high-pressure gas lighting were conducted as long ago as in 1903—indeed, to West Bromwich belongs the distinction of possessing one of the first, if not the first, public lighting installation on this system. It was, however, eventually abandoned as being unsuitable for the requirements then existing. The installation, on what was known as the "Millennium" system, consisted of an electrically driven compressor, in which the gas pressure was raised to 10 inches water column. The lamps each contained one upright burner, consuming 20 cubic feet of gas per hour, and giving a nominal light of 800 candles.

A further system was tried in another portion of the town, in which air was used at a pressure of 2 lbs. per square inch, by means of which the gas was injected through an annular space in the nipple—upright burners being used. The system was kept at work for some three years with fairly satisfactory results, but was replaced on the advent of high efficiency multiple inverted burner low-pressure lamps. From experiments he has made, the author is of opinion that very high efficiencies can be obtained with suitable inverted burners and highly superheated compressed air.

Mention must also be made of the arc lighting in High Street. This is an example of unfortunate disposition of the lamps. The tram poles are too close together to permit of the use of two lamps on each pole, and too far apart to give a good distribution of light as fixed on every alternate pole; whereas if only one lamp per pole had been used, it must have been fixed on the top of the pole, and would consequently have been too high for practical purposes.

Examples of modern high-pressure inverted gas-lamps, working at a pressure of 2 lbs. per square inch, will also be found in St. Michael's Street. These lamps are fitted with automatic lighters by means of which any number can be turned on or off at will. These lamps are of the Keith type, similar to those in use at Westminster. The author has found them to give an efficiency of 55 candles per cubic foot of gas per hour, when tested at a range of 15 feet and 20° below the horizontal with West Bromwich gas (which averages 16·5 candles, "No. 1" standard burner, and 620 B.Th.U.); but when using gas of a lower grade, such as that supplied in London, it is found that these lamps give an efficiency of over 60 candles per cubic foot. The author has, however, observed still higher efficiencies with high-pressure lamps of the Graetzin type when working at 2 lbs. per square inch.

The increased efficiency of high-pressure burners is due to the fact that a greater proportion of the air necessary for combustion can be injected with the gas; there is consequently less cooling effect on the flame. Moreover, complete combustion can be obtained with a smaller flame, which is another way of saying that a higher temperature is developed. The highest flame temperature would be developed if the whole of the air necessary for combustion could be injected with the gas; but this is, of course, unattainable in practice. A small increase in the temperature of the flame produces a comparatively large increase in the amount of light developed. From the foregoing it will be seen that the inverted burner lends itself much better to a high gas pressure than the upright burner, and pre-heating may be carried to a higher degree. In all probability much higher efficiencies will yet be attained in this direction. The essential conditions in high-pressure gas lighting, however, are that the pressure and quality of the gas shall remain absolutely constant. Failure to observe these conditions has, in some instances, caused dissatisfaction with the system.

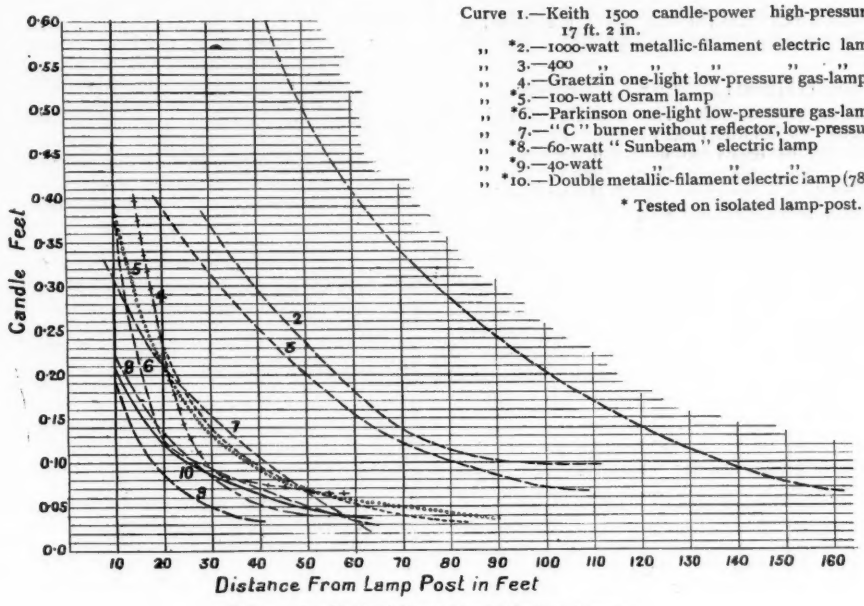
Testing.

The most notable feature in connection with the large number of comparative tests of gas and electrical units which are published from time to time is the singular discrepancy in the observed results. Only recently a series of tests were published, showing results which turned out to be little more than half of those obtained by the officials of the municipal authority which were subsequently published. It seems, therefore, that unless the methods of testing are clearly stated, the results can possess very little value. It is not reasonable to expect such accurate results in the street as in the photometer-room, where all extraneous light can be excluded. Indeed, a street photometer can only be used with precision where a whole street is illuminated with similar units; and even then the results are generally vitiated by the varying reflecting power of the roadway or adjacent buildings. The longer the range at which the observation is taken, the greater is the error from this source. The results shown in fig. 3 were to some extent affected in this manner; but curves Nos. 2, 5, 6, 8, 9, and 10 on the figure were taken in an open space, with no other lights visible, and should therefore possess a greater degree of accuracy. For practical purposes, the author prefers a set of observations taken in the photometer-room at the critical angles. Polar curves of tests taken in this manner are shown on figs. 4 and 5.

It may here be explained that the tests of inverted burners were taken without a globe, in order to eliminate any error due to reflection; but a globe is essential to an inverted burner to develop its true efficiency. For testing electric lamps, a clockwork rotating arrangement was used, with metallic contacts of ample area bearing on glass rings mounted on the spindle, which was properly insulated. The ten-candle Harcourt standard pentane lamp and the Simmance-Abady flicker photometer were employed. For the tests of street-lamps, a photometer was used which was kindly lent to the author by Messrs. Alexander Wright and Co., Limited, of Westminster. This consisted of a metallic filament electric lamp worked from a battery in circuit with which a suitable rheostat and finely calibrated ammeter were placed. A flicker photometer fitted with an angle-finder was again used. The observations were made by varying the resistance and consequently the light emitted by the electric lamp. The reading of the ammeter was then carefully noted, as well as the angle and distance from the lamp. Before starting, and also at the conclusion of the tests, the electric lamp was tested in the photometer-room through the whole range of the ammeter. The observations were taken at right angles to the direction of the light ray from the lamp, and at a height of 4 feet from the ground. This plan was adopted in order that the curves that are shown in fig. 3 might be more intelligible. It is well known that a flame arc lamp, unless fitted with a suitable reflector or dioptric globe, emits its maximum light at angles unsuitable for street lighting. It has therefore become customary to quote the illuminating value of these lamps in mean spherical candle powers. The term, however, conveys no meaning as to the value of the lamp *per se* for street lighting, and its use must be condemned, if for no other reason than its clumsiness and the time required for ascertaining it. It is surely a poor street-lamp that does not illuminate the ground in its immediate vicinity.

Methods of Charging for Public Lighting.

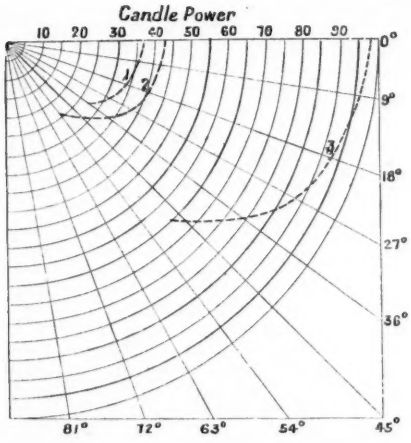
The usual method of charging is to assume a certain consumption of gas or current and to price out at so many lighting hours per annum. This method is satisfactory where the local authority supplies both gas and electricity. When this is not the case, however, difficulties may arise; and it would seem that some other method should be employed. A contract for the gas lighting of Calcutta was recently arranged in which the size of the gas



Curve 1.—Keith 1500 candle-power high-pressure gas-lamp; heigh 17 ft. 2 in.
,, *2.—1000-watt metallic-filament electric lamp; height, 20 ft. 9 in.
,, 3.—400 ,, ,, ,, ,, ,, 17 ,, 11 ,,
,, 4.—Graetzin one-light low-pressure gas-lamp ,, 15 ,, 6 ,,
,, *5.—100-watt Osram lamp ,, 11 ,, 6 ,,
,, *6.—Parkinson one-light low-pressure gas-lamp ,, 11 ,, 6 ,,
,, 7.—"C" burner without reflector, low-pressure gas ,, 11 ,, 5 ,,
,, *8.—60-watt "Sunbeam" electric lamp ,, 15 ,, 6 ,,
,, *9.—40-watt ,, ,, ,, ,, 15 ,, 6 ,,
,, *10.—Double metallic-filament electric lamp (78 watts),, 11 ,, 6 ,,

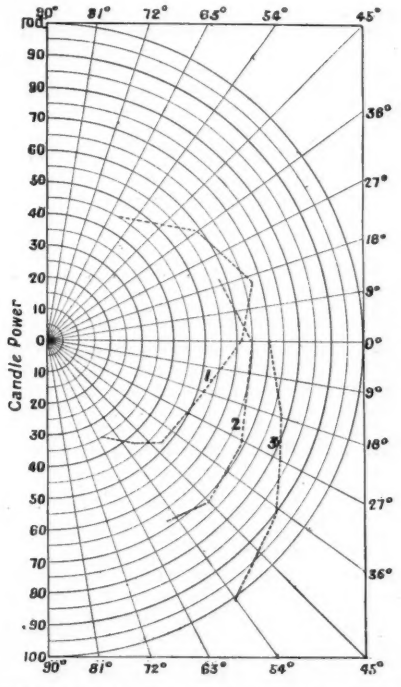
* Tested on isolated lamp-post.

Fig. 3.—Candle Feet Curves from Various Lamps.



Curve 1.—60-watt "Sunbeam" (actual consumption, 59·25 watts at 237 volts).
,, 2.—Double metallic-filament (actual consumption, 78·54 watts at 238 volts).
,, 3.—100-watt Osram (actual consumption, 109·5 watts at 238 volts).

Fig. 4.—Candle-Power Curves of Electric Lamps.



Curve 1.—Welsbach "C" burner, without reflector (consumption, 3·85 cubic feet per hour).
,, 2.—Darwin inverted burner (consumption, 3·5 cubic feet per hour).
,, 3.—Ditto No. 2, with reflector-globe.

Fig. 5.—Candle-Power Curves of Gas-Burners.

nipples and the composition of the gas were specified. The author has found that the gas in passing through the nipple exercises a cutting effect on the metal. Any increased consumption due to this cause would be at the cost of the gas supplier, and would rank as unaccounted-for gas. On the other hand, adjustable nipples are too easily tampered with, and generally give a lower efficiency than a properly drilled one-hole nipple. It may here be noted that when an admixture of water gas is used, the specific gravity being higher, a nipple with a hole of a given size will pass less gas than if coal gas only were used; and in determining the size of the nipple, due attention must be given to this point, as well as to the pressure of the gas during lighting hours in the district in which the burners are to be used. A governor fixed on each lamp is an invaluable adjunct. Higher efficiencies are generally obtainable with a reasonable admixture of water gas; the flame temperature being somewhat higher than that of coal gas.

Still another method of charging for public lighting is that of adopting a fixed price for a definite illuminating power—a system which has recently come into vogue in London, being particularly convenient where high-power units are concerned. This method, however, involves the frequent use of a street photometer. The portable photometers which are principally used in this country are the Harrison, the Weber portable photometer, the Trotter universal photometer, and the Simmance and Abady. The latter has been adopted by the Westminster City Council. It is an ingenious instrument and possesses many advantages; not the least being that it is a direct-reading photometer, and does not involve the interposition of an empirical standard. The principle of the photometer is, briefly, an arrangement by which the amount of light falling upon one side of the photometer disc can be so varied by means of the simple turning of a graduated drum that it can be made exactly equal to the light falling upon the other side of the disc from the street-lamp under test. The graduations of the drum can be read off in 100ths of candles or 20ths of candles according to whether the lamp to be tested is of very high power or of ordinary intensity.

The method of producing the variations of power of the standard light is by the opening and closing of a shutter, which allows more or less of a light of invariable intensity to pass through and impinge upon the disc. It may be best understood by reference to an ordinary photographic camera. In this the rays from an illumined object are projected upon a ground-glass screen, their images being seen inverted. The shutting or opening of a diaphragm such as the iris does not vary the size of the picture, but only the amount of light, which is in proportion to the size of the orifice. In the street photometer, the illuminated object is the interior of the whitened sphere, which is brilliantly illuminated by two electric lamps. The picture of the interior of this sphere is projected, much reduced, upon the white disc of the photometer, always of one size, but varied in luminosity, by the opening or closing of the shutter. The turning of the graduated drum affects the opening in perfect proportion. The accurate determination of the angle at which the test is made, independently of any inclination in the surface of the road, has an important bearing on the accuracy of the tests. This photometer is fitted with an instrument consisting of a combined level and quadrant, weighted so that it will assume a truly vertical position

whereby the angle can be determined with great precision; the reduced image of the lamp being projected through a lens on to the photometric centre.

Authority for Controlling Public Lighting.

There will doubtless be a considerable diversity of opinion among the members of the Institution as to which department of a local authority should be entrusted with the control of the public lighting. From the foregoing, it will be observed and generally conceded that modern exigencies demand the possession of considerable technical knowledge; and if full advantage is to be taken of improvements in the utilization of gas and electricity, the co-operation of the chief officers of both departments should be secured, while the arrangement and disposition of the lamps should be in the hands of a local surveyor or engineer. Only by such co-operation between officials can the interests of the public best be served. It is much to be regretted that in many towns the interests of one department have been deliberately permitted to suffer to the advantage of the other. Personal predilections are indefensible where the public welfare is concerned.

Maintenance.

In discussing the subject of public lighting by gas, the first question that will probably be asked is: "What mantles do you use?" The author's reply to such a question would be that mantles vary very much in quality from time to time, and that in consequence a great variety of mantles are used. For several years in West Bromwich it has been customary, as far as possible, to purchase mantles in the stocking form, impregnated with a standard solution, and not collodionized. The mantles are burnt off and seasoned with high-pressure gas, and carried out in metal boxes fitted with suitable supports. In this way a mantle of the highest quality and strength is obtained. As regards ordinary collodionized mantles, a good quality will be found to be cheapest in the long run. In the choice of a mantle, due consideration must be given to the question of texture. Whereas a mantle of open mesh is suitable for a "lazy" flame, one of closer texture should be used for a strong, active, and well aërated flame. The Woodall-Moon mantle-testing machine will be found to be a most useful apparatus for detecting any falling-off in the quality of the mantles supplied.

Maintenance of Public Lamps in West Bromwich.

Type of Lamp.	Average Number of Mantles Used per Burner per Annum.
Old pattern with "C" burner	8·3
14-inch lamp with angle burner	6·8
16 " " " double inverted burners	7·6
14 " new pattern lamp, with single inverted burner	4·0

The author regrets that he has no authentic particulars of the life of electric lamps of the newest form. This must depend in a large measure upon the regularity of the voltage, which shows considerably more variation in the case of the circuits at the gas-works than would be found in the town supply, though kept perfectly constant during the testing of the lamps for illuminating power.

Automatic Lighting.

A paper on street lighting would in these days be incomplete without some reference to this subject. The average number of lamps lighted and extinguished by a lamplighter appears to be something like 100, and the time occupied in each operation about 1½ hours. So that by the use of automatic lighters the lighting time may be reduced by nearly two hours per day. Automatic lighters, of which there are almost numberless forms, may be divided into two classes—those operated by clockwork and those operated by momentary increase in the pressure of gas in the mains. The latter way may be subdivided into two classes—one in which the gas-valve is operated by a bell floating on mercury or other liquid, and the other in which the gas acts on a diaphragm contained in the instrument which opens and closes the gas-way. The latter form of apparatus is probably the more reliable; but before deciding on an installation, a careful study must be made of the gas pressure in the mains in all parts of the district, or failure will result. If the mains in any part of the town are overworked during lighting hours, there is considerable difficulty in timing the pressure wave so that it may not be excessive and cause the blowing of meters, but shall be sufficient to reach the remote parts of the district, and not be absorbed by the rapid increase which is taking place in the consumption of gas *en route*. Installations of both systems have been used in West Bromwich. But it has been found that the atmospheric conditions have a deleterious effect on the mechanism of the clockwork; and until the distributing system is reorganized, the conditions will be unfavourable to the use of the latter type, unless adopted throughout the town.

The chief cause of failure of automatic lighters is found to be in the bye-pass. It is probable that in the near future pyrophoric ignition will be successfully applied to public lamps. The use of Hertzian waves is also not beyond the bounds of possibility.

Conclusion.

The author has found much difficulty in dealing with the many aspects of interest presented by the subject under consideration within the limited compass of a paper; and it has only been possible to refer briefly to many of them. But, in conclusion, he would again express the conviction that, for the satisfactory lighting of our thoroughfares, units of comparatively small power should be employed, and that they should be so spaced that contrasts in the intensity of the light falling on the road surface should be reduced to a minimum. The Councils of the Institution of Electrical Engineers and the Illuminating Engineering Society have recently appointed Committees for the consideration of the subject of street lighting, and have invited the co-operation of the Council of the Institution of Municipal and County Engineers and of the Institution of Gas Engineers; and it is to be hoped that, as the result of their deliberations, a satisfactory specification will be evolved which will be generally applicable.

Discussion.

Mr. Gilbert Whyatt (Grimsby) said there were two or three remarks in the paper with which he quite disagreed. The author had stated that, in modernizing the lighting of a district, and having decided on the power of the lamps to be installed, the better plan was to rearrange the spacing of the lamp-posts. Personally, he quite admitted the correctness of this view as regarded the residential roads of a town not cut up much by cross streets. But in the centre of a town, where there were a large number of cross streets, it would be different; for if they rearranged their lamps they had to double the number. A suitable distance at which the lamps should be placed apart was 83 yards; but if they put in intermediate lamps, making the space between each 41½ yards, they made the residents in the rest of the town jealous. Therefore it was better, in streets of the kind he had mentioned, to put a double burner in the lantern. Mr. Copp had stated that centre lighting was generally regarded as preferable to side lighting. He (the speaker) did not at all admit this. Road vehicles carried their own lights, and the lighting of thoroughfares was intended for the convenience of foot passengers. His view was that side lighting was the correct thing; centre lighting not being generally regarded as preferable. As to the methods of charging for public lighting, in Grimsby they had lately revised their lighting specification. Only recently they had a specification that the burners should be a certain size, and consume a stated number of cubic feet of gas per hour. But their Electrical Engineer having expressed a desire to light the streets by electricity, they had changed to a definite illuminating power, and specified that at a particular distance from a lamp a certain candle power should be obtained. The Electrical Engineer was prepared to light certain streets at the same rate as that charged for gas—viz., £3 12s. 10d. per lamp; it being specified that there must be 50-candle power at a distance of one foot from the lamps. They had 600 gas-lamps; and the Electrical Engineer had tendered for, and put up, 300 lamps. With regard to the measurement of the light, they admitted that a street photometer could only be used with precision under extraordinary circumstances; but it gave an indication of what the light was. If there was any allegation that the street lighting was not up to the specification, he did not quite see how Mr. Copp was going to take the observations for practical purposes in the photometer room; the work must be done in the street. Beyond these criticisms, he had nothing but commendation for the paper. He had, however, been struck by the lighting-up time in West Bromwich. It seemed that in the summer the lamps were lit fully an hour before sunset, which was an absolute waste of money. For example, the previous night half-past ten—an hour-and-a-quarter after sunset—would have been early enough. The town could save money by deferring lighting-up to, at any rate, an hour after sunset.

The President (Mr. A. D. Greatorex, M.Inst.C.E., Borough Engineer and Surveyor of West Bromwich) remarked that it took an hour-and-a-half to light the lamps.

Mr. Whyatt said if that were so they were much too late in the winter. In November and December they ought to have the lighting completed before sunset. He was prepared to suggest that their atmosphere was very much less clear than that of Grimsby; and in the months he had mentioned probably they ought to finish lighting by three o'clock in the afternoon.

Mr. T. Caink (Worcester) remarked that it was hardly up-to-date for the lamplighter to go round and light and extinguish each lamp in the case of the ordinary gas lighting as compared with electric light, which could be put on and shut off at a moment's notice. The problem of automatic street lighting was one which he had endeavoured to solve by manipulating the pressure in the gas-mains. This method had obvious advantages over that of clockwork systems, inasmuch as advantage could be taken of economizing on light evenings. On the other hand, on dark evenings the light could be turned on as early as the gas manager thought desirable. This meant the saving of a large quantity of gas, and the public were not inconvenienced by the lamps being lighted too late. The difficulties one was confronted with were the variations of pressure in the mains due to the varying consumption; and in the case of lamps which were extinguished by a reduction of pressure an unexpectedly heavy run on the mains might lower the pressure to a point at which the lights would be put out. In order to meet this difficulty, it seemed to him necessary to adopt quite a different form of station governor from that generally in use. The ordinary one was designed for the purpose of maintaining a uniform pressure on the distributing mains—a pressure such as the engineer considered sufficient to meet the demands of the moment; and a governor of this kind seemed to him to render it altogether uncertain what would be the minimum pressure in the remote parts of the district. With the object of overcoming this difficulty, it seemed necessary to devise a governor which would change the pressure so as to suit the demands on the

mains from time to time. Such a governor had been designed; and it had been found to answer the purpose very well. He should like to know whether Mr. Copp had had any experience of a governor of the kind, for it seemed to him (the speaker) that the question of automatic lighting depended upon the use of an appliance which would automatically change the pressure to suit the consumption, and thus render the pressure uniform throughout. In regard to maintaining the bye-passes in the lamps, these were apt to become choked up. The difficulty, he thought, could be overcome by the use of electric ignition. It could be quite easily done by having a small battery in each lamp-post. Automatic gas lighting could thus be made successful; and in this respect it would not stand at the same disadvantage as at present in comparison with electric lighting.

Mr. A. Richardson (Handsworth) inquired whether Mr. Copp had made use of the tramway poles for street lighting purposes. If he had tried fixing incandescent gas-lamps on to the poles, he (the speaker) would like to know whether he had found the life of the mantles satisfactory.

Mr. S. Douglas (Kenilworth) asked whether the street-lamp described in the paper was on the market; also, who was the maker, and what was the approximate price. With respect to the governors, he should like to have Mr. Copp's opinion about the cheaper form of governors at (say) 1s. 6d. and 2s. each, for use in connection with vertical incandescent burners.

Mr. W. Jones (Colwyn Bay) said he should much like to know whether advantage was taken by local authorities generally of dispensing with lighting on the five nights when the moon was full, for it seemed to be the practice in his own neighbourhood to economize in this way.

Mr. Nelson F. Dennis (West Hartlepool) said he was one of those who agreed with the writer of the paper when he stated that "the better plan was to rearrange the spaces between the lamps." The object they had in view in street lighting was of course, to get the best results they could; but people in his part of the country would not be satisfied with lamps 83 yards apart. In his town, the lamps in what he would call first-class thoroughfares were from 28 to 37 yards apart; and in streets the distance was not more than 56 yards. But even then they were not entirely free from complaints. He thought the idea of gas lighting was to distribute the light over the whole street; but if they were going to duplicate the burners, they would double the cost of gas without distributing the light over a doubled area. His view was that where it was possible the best thing was to rearrange the spacing of the lamps rather than put an increased number of lamps at the corners of streets.

Mr. J. Birch (East Ham) inquired whether Mr. Copp had had any experience of, or information to give with regard to, the efficiency, with reference to both lighting and maintenance, of the inverted burner, either single or in duplicate, in the lantern.

Mr. F. Oscar Kirby (Doncaster) said Mr. Copp had dealt with his subject in an exhaustive manner. There was a great deal of information in the paper, and many points of value for future reference. He should like, however, to ask the author one or two questions. In the first place, he wished a further explanation of the statement that "the standard to be adopted in any town or locality should bear some relationship to its rateable value per head of the population." It seemed to him (the speaker) that such a standard would not be generally applicable. Was it intended to convey the idea of a standard rising *pro ratâ* with the rateable value of the locality lighted? If so, one might instance the case of a side street with highly-assessed factories or warehouses on both sides, and practically no population or pedestrian traffic during the lighting hours. Farther on in the paper three essential conditions for street lighting were quoted. He would suggest a fourth, which one might term depth of illumination. For satisfactory, uniform illumination there must be sufficient light for high vehicles—for instance, motor omnibuses—though, of course, it might be said that all vehicles should furnish their own means of illumination. Mr. Copp mentioned the fact that large units of light placed fairly high might shine through the first-floor windows. This would not appear to be a serious objection, as in thoroughfares, such as Victoria Street, Westminster, where large units were necessary, the first-floor rooms were not generally in use during lighting hours, being mostly offices or store rooms. Mr. Copp's figures of the relative candle power, height, and spacing of lamps did not appear exactly to confirm the axiom quoted in his paper—and with which he (the speaker) entirely concurred—that the greater the candle power of the lamp the higher it should be placed. But this might be due to some subtle polar characteristics of the sources of light compared, with which he was unacquainted. Could he take it that the figures adduced were the results of actual tests? At any rate, they did not appear to be in accord with the law of inverse squares. They were indebted to Mr. Copp for drawing their attention to the doubtful utility for general use of the term "mean spherical candle power" as a standard for illumination. This standard had been adopted in connection with the Westminster lighting contract, and might be the most satisfactory one for the conditions obtaining in that case. But there was perhaps a tendency to look upon it as a guide and precedent for every case. It was therefore important to bear in mind that the practical value of a lighting source should be computed on a basis which had reference to the conditions of usage. As Mr. Copp pertinently stated, it was a poor street-lamp that did not illuminate the ground in its immediate vicinity.

Mr. H. A. Garrett (Torquay), alluding to the question of methods of charging for public lighting, said he had not heard any mention of the average meter system adopted in some towns. He noticed that it was stated in the paper that it was usual to assume a certain consumption of gas or of current. But this was capable of being widely dealt with; and the question was whether it was not better to adopt the average meter system, and pay for the actual consumption. Had Mr. Copp any experience of the method he referred to?

The President said, before calling upon Mr. Copp to reply, he would ask the meeting to pass a very hearty vote of thanks to him for his paper. When he asked him to prepare the paper, he did so for the reason that he noticed, from the volumes of "Transactions," that they had not for many years had a contribution on the subject from the practical point of view. It was an important question, and one upon which he knew Mr. Copp was able to give them some valuable information. With regard to the spacing of the lamps, the hours of lighting, and similar matters in West Bromwich, these were in the hands of the Highways Committee; the Gas Committee being only responsible for the supply of gas and lighting the lamps in the same way as a private company. The other question was a matter which practically belonged to his own department. Of course, in arranging these things, they worked together in the amicable way in which he thought the officials of every public authority should do.

The vote of thanks having been accorded,

Mr. Copp, in acknowledgment, said he was grateful for the kind reception which had been given to his paper. At the same time, he welcomed the criticism upon it, which, of course, was what he had written the paper for. They all had their own opinions, and the discussion of papers often resulted in their modifying their views on different points. He had some difficulty in answering Mr. Eayr's question as to where the various lamps were to be seen, for they were dotted promiscuously about the town. They were improving the more important thoroughfares first; but they recognized that there was a great deal yet to be done to improve the lighting of the town as a whole. Some high-pressure lamps would be found in St. Michael's Street, and the new form of inverted burner could be seen in Beeches Road. In the High Street they would see the electric arc lights, which, in fairness to the Electricity Department, he ought to say were somewhat antiquated. At eleven o'clock these were turned out, and metallic filament lamps, which were fixed lower down the poles, were switched on; and the question was whether the road was not better lighted after this was done than before. At any rate, there was not much difference. As to Mr. Whyatt's remarks with respect to the spacing of lamps, the remedy there seemed to be to have higher lamp-posts and raise the unit of illumination. In regard to centre lighting, he had been very careful in his paper to avoid saying that he was in favour of it. He was not; but, judging by what he read in the Technical Press, and by what had been done in Germany, and having in mind also the experiments which had been carried out in Cannon Street, London, he thought it was very probable that centre lighting would take a very important place in the future. Personally, however, as he had said, he did not agree with it. Unless the unit of light were very high, a horse and cart proceeding down the centre of the road would throw a shadow on the pavement; and the system would be objectionable on this account. Several places in England had tried it; but it was very common on the Continent. As to the lighting in Grimsby, they who read communications on the subject of lighting were forced to the conclusion that in this connection Grimsby was more or less a law unto itself. He had carefully refrained from giving the comparative costs of gas and electric light. But everyone there knew the efficiency obtainable from ordinary town gas; and they must know also the consumption of electricity by ordinary metallic filament lamps. Of course, some people preferred electric lighting for reasons to which he had alluded in the paper. One would not expect to find gas lighting on the Brighton Front, for instance. There were places suitable for both kinds of illumination; and they should keep open minds on the subject, and adopt each illuminant as the circumstances of the case warranted. The times of lighting up and extinguishing which he had given were the actual figures for the previous year; but the climatic peculiarities of West Bromwich made the subject a rather difficult one. With reference to Mr. Caink's remarks as to pressure lighting, this was very good in a flat district, where there was an equable pressure all over the town; otherwise they had a large number of failures. Therefore he preferred a clockwork automatic lighting and extinguishing system. They had had every form at work; and they flattered themselves that they knew something about it. The extinguishing of the lamps was not effected by taking off the pressure; it was invariably done by another wave of pressure. As regarded the governor for proportioning the pressure to the consumption of gas, this object was accomplished by means of a Braddock governor, which was a double valve governor. The method of applying the pressure was usually to lower a tank of water on to the top of the governor; and a tap gradually discharged the water—the pressure assuming its usual height when the tank was emptied. Mr. Caink seemed to assume that automatic lighting was more or less experimental. This was not so; it was an established fact, as regarded both pressure and clockwork systems. There were at the present time whole districts lighted automatically; one of the most notable cases being Newcastle-on-Tyne, where several thousand lamps were dealt with in this way. With regard to Mr. Richardson's question as to lamps on tramway poles, he had found inverted lamps fixed in

this way perfectly satisfactory, and the renewals less than with the ordinary poles. As to the question put by Mr. Douglas, he (Mr. Copp) was afraid the lamp referred to could not be obtained at present. It was not "a thing of beauty" yet; but he had re-designed it in a way that made it considerably more presentable. One of the main points of the lamp was that the reflectors could be kept clean, because the air was absolutely excluded. He knew of no satisfactory governors for street-lamps at the price of 1s. 6d. or 2s. As to the cessation of lighting at certain periods, this was perfectly satisfactory for country districts, but totally inadmissible for urban districts. He should not like to contemplate the effects of leaving the town of West Bromwich unlighted during the period of full moon, for very frequently this period passed without their knowing it. He could not give figures as to the double-burner gas-lamps. He did not favour these at all. With regard to Mr. Kirby's remarks, when he said the standard should bear some relationship to the rateable value of the town, he meant this as a general statement. He quite agreed that he should have included depth of illumination as one of the essential conditions of satisfactory street lighting. His axiom that "the greater the candle power of the lamp the higher it should be placed" had been criticized by Mr. Kirby. But he had put in figures to illustrate the truth of the statement; and if Mr. Kirby would examine them, he would admit that he (Mr. Copp) was correct. As to Mr. Garrett's observations in regard to the average meter system, there was not so much necessity for it nowadays. They had tried the electric ignition method in West Bromwich, and he really thought it was a practical system. But some three months ago he decided to do away with the bye-passes, some of which were exceedingly extravagant, and light by means of an acetylene torch. This was an extremely handy arrangement, and possessed the advantage that it did not blow out in the worst weather. He had not received any complaint with regard to it from the lamplighters, which was a sure sign that it was satisfactory. He desired to emphasize the point as to the question of testing. He knew he would be criticized by his friends in the electrical world for taking the observations at right angles to the direction of the light-ray, and at a height of 4 feet from the ground; but, as he had said, he adopted this plan in order that the curves might be more intelligible on the chart.

SOCIETY OF CHEMICAL INDUSTRY.

Annual Meeting in Sheffield.

The Annual Meeting of the Society was held at Sheffield last week, under the chairmanship of Mr. Walter F. Reid, of London, the retiring President.

At the business meeting, on Wednesday, the members were accorded a hearty welcome by the Master Cutler (Alderman Senior) and by Councillor Cecil Wilson. In acknowledging the welcome, the retiring President said there was no city in the United Kingdom which offered more points of interest than Sheffield, especially to those engaged in industrial pursuits.

PRESIDENTIAL ADDRESS.

In opening his address, Mr. Reid expressed the opinion that the chemical industry had never known more active and progressive times than the present. New apparatus, methods, and products appeared with such rapidity that it had become extremely difficult to keep pace with all the applications of science to the industry. The tendency of the present age was towards specialization; but too minute subdivision had its disadvantages. The higher officials of a chemical factory must have some knowledge of a number of subjects besides chemistry. There would always be a demand for trained men who had a good knowledge of science generally, and especially of the methods of applying it. The chemical industry was far ahead of any other industry in the percentage of trained people it employed. It was similarly placed in regard to the value per head of the products of those employed. Iron and steel came second.

It was sometimes alleged that the nature of the training given to students in Great Britain was not of a sufficiently practical character, and that some foreign nations were superior to us in this respect. In his view, it could not be said at present that the facilities for acquiring knowledge were less in Great Britain than in any other country. In fact, in some of our institutions they were superior. Quite recently, industrial bursaries had been instituted, which went a little farther than the ordinary scholarships in that they provided assistance for the student after he had gone through the university course. The object aimed at was to provide practical instruction in factories for a period varying from a year to three years. He urged the need for information as to the careers of students after they left their scholarships at the universities and technical schools, and declared that information of this character was the only test of the final measure of success. He had engaged hundreds of young men; and when they came to him, the first thing they told him was that they had a certain degree. It was especially those students he had found, as a rule, wanting in the practical faculty. The fact that they had obtained their degree was one point upon which they were expecting to get employment in some industrial concern. An employer, if he was experienced in the employment of young men, did not generally attach first importance to a degree, however high it might be. Students, of course, had great difficulty in obtaining practical technical experience.

Doubts had recently been expressed as to the utility of research work for students. Probably these doubts were due to the use of the word in more than one sense. From the scientific point of view, the working-out of any new problem might be called research work; but technologically research work should have a definite aim and some application of the knowledge gained for the benefit of mankind. Much of the so-called research work was unfortunately of the poorest possible description from the mental point of view. Simple facts, easily ascertained, were strung together without literary ability, and without the slightest attempt at drawing any useful conclusions. Regarded as a means of mental development, technological research had much higher value than so-called pure scientific research; for it not only included the latter, but added to it. As things were at present, the problem for the student was how to acquire practical knowledge at the commencement of his career. In this employers might incidentally assist by giving their younger employees more leisure to attend meetings of such societies as the Society of Chemical Industry, and by procuring journals and other literature that the assistant was unable to purchase. A good factory library was of the greatest pecuniary benefit both to employer and employed. But in how many factories was one to be found? The rapid march of pro gress in chemical industry necessitated continuous study if they wished to keep up to date. Whether they liked it or not, they were all, and must remain, students.

One often heard complaints that the times were not so good as they used to be, and that profits on manufactured goods were now small. In the older industries, this was, no doubt, true. But there were many new industries in which the manufacturer reaped a very satisfactory harvest, sometimes from an extremely small beginning. Bearing this in mind, every manufacturer should encourage his assistants to make observations and investigations bearing upon his business. Sometimes an apparently casual observation might lead to important results if it was followed up; but if the factory chemist was taught to consider himself merely as a kind of testing-machine, and original observation was discouraged, the business could not progress.

At the close of the address, a vote of thanks was accorded to the retiring President, on the motion of Dr. Rudolph Messel, of London, the new President, seconded by Dr. Russell Moore, of New York.

The Annual Report.

In their annual report, which was adopted, the Council stated that the number of members now is 4300, compared with 4299 at the last meeting. The New York Section has availed itself of the opportunity of the meeting of the Eighth International Congress of Affiliated Chemistry in America next year to invite the Society to hold its next annual meeting in New York. This invitation has been accepted. On the report of Dr. Divers, urging the need of a Department of Chemical Technology at the Imperial College of Science and Technology, the Council passed a resolution expressing the opinion that the governing body should forthwith proceed to formulate and carry out some complete scheme of training in chemical technology; and they authorized Dr. Divers, as the Society's representative on the Board, to express this formally as the opinion of the Council.

Social Functions and Visits to Works.

At the close of the morning session, the members and their ladies had luncheon at the Grand Hotel, on the invitation of the President of the Yorkshire Section of the Society, Mr. E. A. Brotherton. In his unavoidable absence, Mr. F. W. Branson (Leeds) presided. In the afternoon, parties visited various works; and the annual dinner of the Society was held at the Grand Hotel in the evening.

Those of the members of the Society who remained in Sheffield on Thursday saw quite enough to justify the President's declaration, in the opening of his address, that no other city in the United Kingdom presents so many points of interest to people engaged in industrial pursuits. Some of the members spent the day at the works of Messrs. Newton, Chambers, and Co., Limited, at Rockingham, and of the Wharncliffe Silkstone Colliery Company, Limited, at Tankersley. Others, during the morning, visited the Grimesthorpe works of the Sheffield Gas Company, and the Metallurgical and Engineering Department of the University. Over the latter the party were conducted by Professors Arnold and M'William. The tour of inspection included a visit to the crucible furnace, where two ingots were cast, and the effect shown of a trace of aluminium on the steel; the ore containing the aluminium being about 3 inches shorter than the other, owing to the elimination by it of the gas of the ingot. In the afternoon, other works and the University buildings and laboratories were visited. In the evening, there was a reception by the Lord Mayor and Lady Mayoress in the Town Hall, followed by a dance.

The members concluded their visit to Sheffield with a delightful trip on Friday to Chatsworth and Haddon Hall; the party numbering about 150. At Chatsworth, luncheon was served in the coach-house, under the presidency of Mr. Reid. At the conclusion of the repast, the party drove to Haddon Hall, where the afternoon was spent—tea being served in the grounds. In the evening, a smoking concert was held at the Grand Hotel, Sheffield.

CHARGING CHAMBER RETORTS.

In the "JOURNAL" for the 17th of January last (p. 156), there was an illustrated description of an arrangement for charging chamber retorts, for which a patent had been taken out for France by the Compagnie Générale de Construction de Fours, of Paris. Some changes have since been made which are the subject of an addition to the original patent; and the following particulars are taken from the specification.

According to the first patent, the arrangement consisted of a closed discharge channel or shoot running from the fixed hopper to the retort to be filled. The addition relates to another form of construction, in which the shoot, instead of being fixed to the opening of the hopper, is placed upon a movable carriage, so that it can be run in front of each of the chambers forming one or several benches of retorts. The object of the arrangement is to reduce considerably the cost of the plant, by dispensing with the use of a separate shoot for each retort. The improved form of construction is shown, by way of example, in the accompanying illustrations.

Fig. 1 is a transverse elevation of the truck carrying the shoot in the position for filling the retort; fig. 2, a longitudinal view of the shoot; and fig. 3, a similar view to fig. 1, the parts of the shoot being in the position for moving.

The shoot consists of two pipes, A and B, oscillating on common axes C, supported by a frame D suspended from another E mounted on wheels. These frames form a carriage which can be moved lengthwise above the settings on rails supported by posts fixed to the iron bars between which the hoppers are placed. The pipe B is in the shape of a funnel (one of its sides being raised) provided with an opening communicating with the chimney shaft F, which, in this position, is also supported by the truck. The other pipe is composed of two cheeks situated between the side

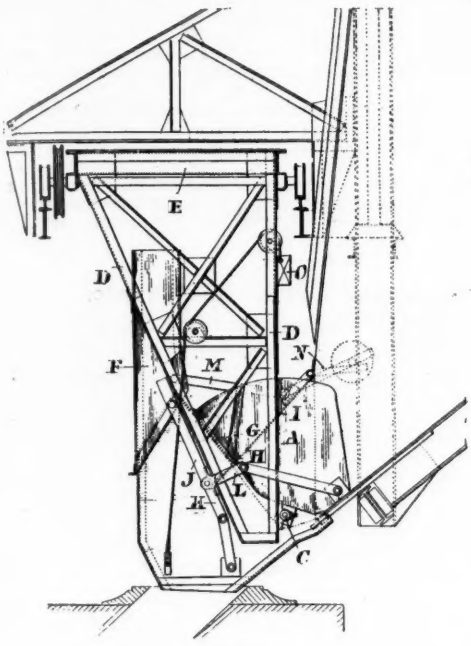


Fig. 1.

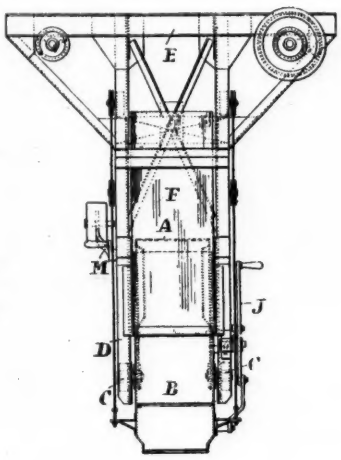


Fig. 2.

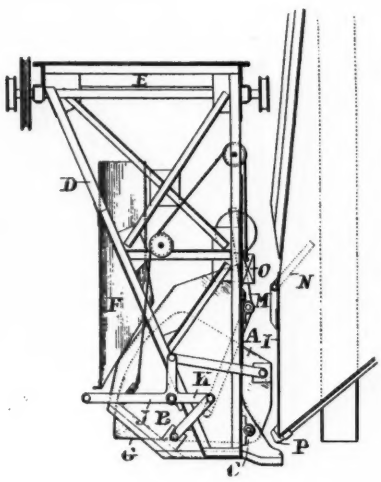


Fig. 3.

walls of the first pipe, and united with each other by a partition G, designed to guide the products of combustion from the retort into the chimney-shaft. The lower edge of this partition terminates in an angle-iron H, against which the door of the hopper I rests when open.

On one of the rear sides of the framework there is a hinged hand lever J, provided with two arms K L, one connected by a rod with the pipe B, and the other in a similar way with the pipe A. The hinges of the lever J and the two connecting-rods are fixed so that when the lever is pulled down, the pipes A and B tend to swing in the opposite direction while engaging one with the other (see fig. 3); and, on the contrary, when the lever is raised they move to a position of prolongation, as in fig. 1.

On one of its front sides, the framework supports the hinge axis of a lever M, furnished with a counterweight. By the aid of this lever the arm N can be worked so as to keep the hopper door open. The two pipes are equilibrated by a counterweight O, sliding against a plate which is fixed on the framework. This counterweight is connected with the pipe B by a rope running over pulleys as shown.

The working of the appliance is as follows: In their ordinary position of rest, the pipes A B are brought one towards the other, so that the pipe B will be raised to such a height as to escape the mouth of the retort and its lid, and the pipe A will be disengaged from the sides of the hopper, as in fig. 3. In this position of the parts, the counterweight of the lever M is lifted sufficiently to be outside the face of the hopper. Thus arranged, the truck and everything it carries can be run lengthwise over the settings without coming in contact with any obstacle.

To charge a retort, the lid is opened, and the truck run forward so that it will present the pipe B above the opening. The lever J is then raised; the effect being to cause the pipe to drop into the mouth of the retort, and the cheeks of the pipe A to be pressed against each side of the walls of the hopper. All that has now to be done is to open the hopper door by turning the catch P which secures it, and letting down the counterweight against the arm N forming part of the door. The latter, both from the pressure of the coal and the action of the counterweight, is moved against the angle-iron H of the partition G, and constitutes the upper slanting wall of the shoot, of which the cheeks of the pipe A form the side walls. The coal running from the hopper thus passes through a closed channel, which conveys it safely into the mouth of the retort. The products of combustion given off during the operation of charging are collected by the pipe B, and led into the chimney shaft F, so as to avoid accidents to the workmen.

Gas-Chambers at Elbeuf.

From the last "Revue Bibliographique" of the Société Technique du Gaz en France, we take the following particulars of a bench of Koppers ovens erected at the new gas-works at Elbeuf. There are six chambers divided into three sets; each set having its producer, regenerator, and hydraulic main. Two units work together, leaving the third in reserve. Each chamber measures 5·60 m. long by 0·475 m. wide by 2·80 m. high. The charge is about 5¾ tons; and the carbonization takes 24 hours. The charge is made in the morning, after which only the producers require attention—being filled every three hours. Clinkering is done once in 24 hours. Besides the foreman, a squad of seven men is required for the day, and two men at night. Tests made from March 21 to 28 gave the following results: With English coal, having 13·66 per cent. of ash and giving 75·10 per cent. of coke, and with the weight of charge already given, the gas produced was 296 cubic metres per metric ton. The fuel consumed was 15·3 per cent. of the coal carbonized. The calorific power was 5253 calories. During the latter days of the test, the percentage gas analysis was:—

Hydrogen	50	Carbonic acid	1·8
Methane	34	Carbonic oxide	4·9
Other hydrocarbons	3·3	Nitrogen	6·0

The coke was like metallurgical coke, but less hard, and gave but little dust. The maximum daily output is 6000 cubic metres.

Mr. HENRY FURNELL PEATY, who is on the staff of the Hornsey Gas Company, obtained, on the 8th inst., the degree of Master of Science (Engineering) by thesis, at the Victoria University, Manchester.

Mr. J. W. BROADHEAD, Managing-Director of Messrs. Robert Dempster and Sons, Limited, has been elected Chairman of Section III. of the Society of British Gas Industries, in place of the late Mr. W. J. Jenkins.

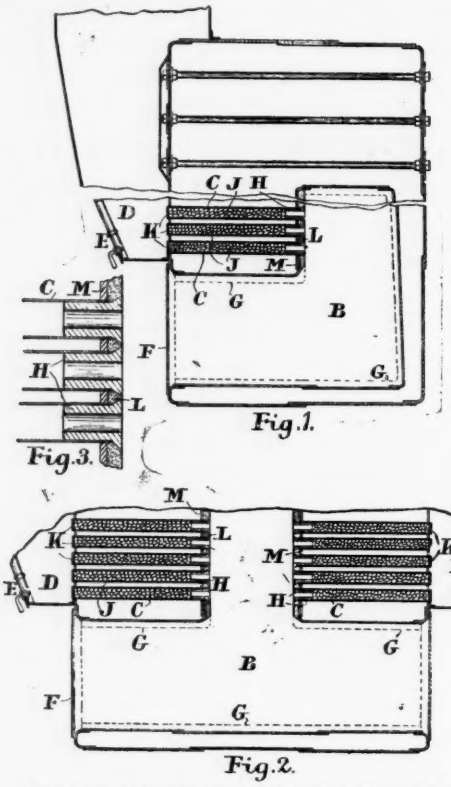
REGISTER OF PATENTS.

Gas Steam-Generators.

BONE, W. A., of Leeds University, WILSON, J. W., of Armley, Leeds, and M'COURT, C. D., of Balham Hill, S.W.

No. 17,560; July 25, 1910.

According to this invention, liquid or gaseous fuel is burned in a combustion chamber situated within (or in proximity to) the shell of the boiler. The boiler tubes through which the products of combustion pass after leaving the combustion chamber are packed with refractory material in a fragmentary, granular, or globular condition; and, "owing to this packing, a much higher heat transmission is obtainable per unit area of tube surface," and the patentees are "thereby enabled to reduce greatly the length of tube necessary to effect a given cooling of the furnace gases as compared with the length heretofore generally in use."



The Bone-Wilson-M'Court Gas-Heated Steam-Boiler.

Figs. 1 and 2 show sectional elevations of steam-generators constructed according to the invention. Fig. 3 shows a means of protecting the tube-plate from excessive heating.

In figs. 1 and 2, the cylindrical boiler shell is provided with an internal combustion chamber B and boiler-tubes C. D is an off-take connected with a fan or other suction device (not shown) provided with a door E adapted to give easy access to the tubes for the purpose of charging with granular material as hereafter described. The combustion chamber is provided with a door F (lined with fire-clay) furnished with openings for the introduction and lighting of burners of any approved pattern. The air required for combustion, entering the combustion chamber through the openings in the door, is drawn in under the action of a fan, and, in the case of liquid fuel, is also forced in by the injection of the compressed air or steam supplied to the liquid fuel burners.

The boiler-tubes are provided with fire-clay perforated plugs or ferrules H adapted to fit the tubes, and are packed with granular refractory material J—for example, fire-brick crushed to such a size as will pass a sieve of one mesh to the linear inch; the finer material, such as will pass a sieve of two meshes to the linear inch, being rejected. The refractory material is retained in position at the other ends of the tubes by metallic grids or spiders K.

The fire-clay plugs or ferrules, while serving to retain the granular material in the tubes, serve also to protect the tubes at their entrance ends from excessive heating and to direct centrally the hot gases into the granular material, and thus producing at or about the place where the gases enter the granular material a temperature higher than would be obtained if the gases were allowed free entrance over the entire open end of the tube.

The plugs H are so constructed that, while a portion of their length tightly fits the tubes or can be made so to do by winding with asbestos cord or the like, the projecting part tapers outwardly so as to retain in position a gannister or like lining L adjacent to the usual tube plate M, which carries the tubes C and through which the projecting plugs pass. This is shown in detail in fig. 3. Where, however, the tubes are too closely assembled to admit of this arrangement, the projecting ends of the plugs may be enlarged in such a manner as to cover, or nearly cover, the tube plate M when the plugs are assembled in position—the interstices (if any) being filled with fire-clay, gannister, or other refractory material of such a nature as to undergo but little shrinkage in burning.

The granular material with which the tubes are packed "serves to greatly increase the heat transmission through the walls of the tubes to the surrounding water," and in so doing appears (according to the patentees) to act in the following manner. Part of the heat conveyed to the granular material is radiated thence to the walls of the containing tube, while at the same time the granular material serves to mix the gases in transit, continually deflecting gases from the centre to the sides, and *vice versâ*, and repeatedly causing the hot gases to impinge on the walls of the containing tube. The part of the granular material which becomes incandescent serves to assist the combustion of any part of the fuel which on leaving the combustion chamber is not completely burnt.

The inventors have found, as the result of numerous experiments, that the intensity of heat transmission through the walls of the tubes depends, among other things, on the size of the fragments with which the tubes are packed. The larger the fragments employed, the longer will be the tubes necessary to effect a given cooling of the furnace gases. They have found that when the size of the fragments employed is such as will pass a sieve of one mesh to the linear inch but will not pass a sieve of two meshes to the linear inch, a boiler-tube 3 feet long and of 3-inch bore is sufficient to cool the furnace gases to a temperature at which they may conveniently be passed to a feed-water heater.

The feed-water heater may conveniently consist of tubes packed with granular material to which the products of combustion are passed on leaving the boiler; the feed-water being caused to pass around the tubes on its way to the boiler. They find that if the tubes in the feed-water heater be of the same number and the same bore as those employed in the boiler, the length of the tubes in the feed-water heater may conveniently be one-third the length of the tubes in the boiler.

Manufacture of Ammonium Sulphate.

CHRISTIE, M. G., of Crigglestone, near Wakefield.

No. 15,817; July 1, 1910.

In order to avoid the separate manufacture of sulphuric acid for absorbing ammonia from gases containing it, it has been proposed, the patentee points out, to pass gases containing sulphur dioxide, or a solution of sulphurous acid or bisulphite, into the absorbing vessel—such as the ordinary saturator—whereby ammonium sulphite is chiefly produced. This is subsequently oxidized by the air, so that much of it becomes ammonium sulphate. But this procedure is impossible when the temperature of the gases passing into the saturator is maintained high enough to prevent condensation of the water vapour which they contain, and involves difficulty on account of the escape of sulphur dioxide into the purified gas unless the temperature of the saturator is kept very low.

According to the present invention, the same object (of avoiding the separate manufacture of sulphuric acid) is attained, and difficulties in connection with the temperature of the saturator are said to be avoided, by passing sulphur dioxide, or gases containing it, into the liquid in the saturator or absorbing vessel and at the same time subjecting the liquid to electrolysis—"thus taking advantage of the known fact that sulphuric acid is formed when sulphur dioxide is passed into a bath in which electrolysis of an acid or salt is proceeding." Preferably, the sulphur dioxide gases, obtained in any known manner, are passed into the liquid only around the anode or anodes.

It is in some cases preferable, he says, to have an electrolytic bath apart from the saturator and to circulate the liquor through both the saturator and the bath. The sulphurous gases are passed into the anode compartment of the electrolytic bath, and there converted into sulphuric acid, which, in turn, is converted into ammonium sulphate in the saturator. As the liquor in the saturator is a strong solution of ammonium sulphate, it is easily electrolyzed, and any ammonia evolved at the cathode is absorbed in the saturator or in the anode compartment of the electrolytic bath. For this purpose, the cathode compartment may have a cover from which springs a pipe for leading the evolved gases into the saturator or into the anode compartment.

Concluding his specification, the patentee says: "In modern practice, the ammonium sulphate is removed from the saturator in the solid state. The drainings from the solid may conveniently constitute the electrolytic bath for my purpose. Or the sulphur dioxide may be absorbed in these drainings or mother liquor before or after the drainings have been passed through the anode compartment of the electrolytic bath and before they have been returned to the saturator. When operating with gases containing sulphur dioxide as well as ammonia, or when sulphur dioxide has been added to such gases, the whole gas may be passed through the electrolytic bath."

Automatically Regulating the Flow of Liquids.

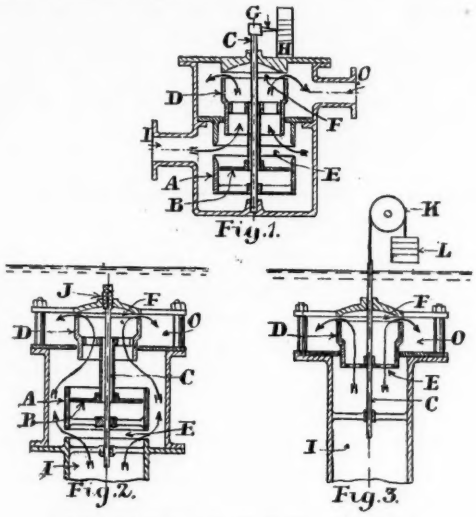
KENT, W. G., and HODGSON, J. L., of High Holborn, W.C.

No. 22,184; Sept. 24, 1910.

This apparatus is intended primarily for controlling the rate of discharge from filter-beds, so as to ensure a constant rate of filtration. It is for the same purpose as that described in patents No. 832 of 1876, No. 23,429 of 1898, No. 13,595 of 1903, and No. 9213 of 1908. It consists essentially of valve apparatus having a measuring orifice across which a difference of pressure is obtained according to the rate of flow, and a balance throttle valve—*i.e.*, a valve that will close down the flow without appreciable force having to be exerted—which is operated by the difference of pressure across the measuring orifice.

It is so arranged that the difference of pressure across the measuring orifice acting on a piston attached to the throttle valve balances the weight of the valve and its attachments at the flow at which the apparatus is set to regulate. Any increase of flow increases the difference

of pressure and causes the valve to lift and close down the flow; while any decrease of the flow in the same manner causes the valve to open up. The flow is therefore maintained constant. The amount passing depends on the size of the measuring orifice and the weight of the throttle valve and its attachments.



Kent and Hodgson's Fluid-Flow Regulator.

In the illustrations, I is the inlet; O, the outlet; E, the measuring orifice; C, the balance-valve; and F, the point at which the flow is throttled.

In figs. 1 and 2, the difference of pressure acts on the two sides of the piston B, which fits loosely in the cylinder A. The rate of flow is controlled by altering the width of the measuring orifice E by raising or lowering the central shaft C, to which the cylinder A (whose edge forms part of the measuring orifice) is attached. In fig. 1, a pointer is shown attached to C so that the rate of flow passing may be directly read. In fig. 2, the shaft C, carrying the cylinder A, is raised and lowered by means of the screw J. Fig. 1 shows an "enclosed" type of regulating valve, which may form part of a pressure pipe-line; while figs. 2 and 3 show an "open" type, which is placed on the filter outlet and is usually "drowned."

The balanced throttle valve D is made of two diameters (as shown), so that the high pressure against which the valve is regulating is balanced at the two ends of the smaller diameter cylinder, and the low pressure into which it discharges is balanced at the two ends by the larger diameter cylinder.

This throttle valve D thus differs very essentially from that shown in patent No. 13,595 of 1903, where it is made of one diameter only, so that the high pressure acts on the bottom of the valve and the lower pressure acts on the top, and the valve is not balanced.

Careful experiments have, it is said, been made on this point, which show that the valve does not work satisfactorily unless this balancing is carried out as described.

In patents No. 832 of 1876, No. 23,429 of 1898, and No. 9213 of 1908, the throttling is done by two discs or pistons opening or closing two openings, which, although it gives a balanced throttle valve, is not a suitable way of mechanically carrying out the throttling. In fig. 3, the measuring orifice E is attached to the balanced throttle valve. The rate of flow may in this case be controlled by balancing part of the weight of the moving parts by means of weights L passing over a pulley K.

Mixing Fluids in Given Proportions.

COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIEL D'USINES A GAZ, of Paris.

No. 27,703; Nov. 28, 1910. Date claimed under International Convention, Dec. 1, 1909.

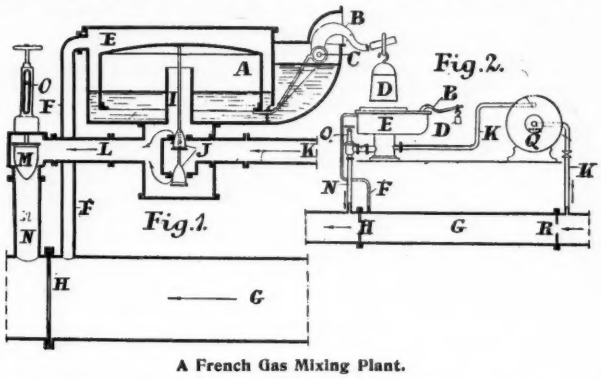
This invention relates to a regulator adapted for mixing (say) lighting gas and acetylene, or gas and air in determined proportion, whatever be their respective pressures and densities—the proportion in question being varied at will by closing to a greater or less extent an orifice admitting one of the two fluids. It can also be used for measuring the respective volumes or the total volume of the two fluids mixed. The regulator can, moreover, be placed on a shunt of a main conduit so as to serve for the regulation of the volume supplied by the shunt, in proportion to that passing through the main conduit, which allows of a proportional meter to be inserted in the shunt.

Fig. 1 shows a vertical section of the regulator. Fig. 2 shows diagrammatically the application of the apparatus in combination with a proportional counting device arranged in the shunt.

In the following description, it is assumed that the regulator is used for causing a certain quantity of acetylene to be distributed in a conduit for coal gas; but the arrangement of the parts, as well as the operation, would remain the same whatever be the nature of the constituents of the final mixture.

The regulator comprises an oscillating bell A, the immersed lower edge of which rests on the arm of a lever B, pivoted about the spindle C or resting on knife edges similar to those of the beam of a weighing machine. The bell is balanced exactly by means of an outer weight D secured to the second arm of the lever; and it works in a closed vat E, which is in communication, by the pipe F, with the conduit G, for the coal gas. The joint of the pipe F, with the conduit G, is in front of a diaphragm H in the conduit, and which has an orifice producing a loss of head which varies approximately in proportion to the square of the output.

The bell is provided in the centre with a spindle I, carrying at the lower end an obturator or double cone J (or any other kind of balanced valve arrangement), by means of which it is possible to cancel, by equal and reverse reactions, the effect of the inlet pressure of the acetylene circulating in the conduit K, in case the pressure is variable. The



A French Gas Mixing Plant.

fixed or variable pressure acting in the conduit K must, of course, always remain greater than that in the conduit G.

The escape of the acetylene takes place through a branch L, communicating with the bottom face of the bell A, and terminating in a valve with a parabolic closing member or valve M. The latter is, in its turn, connected to the conduit G behind the diaphragm by a pipe N. The valve M is provided with an opening indicator O, and acts on the acetylene as a diaphragm having a cross section adjustable at will, for the purpose of modifying the proportion of the mixture.

The operation is as follows: Any modification of the pressure in G, or of the admission pressure of the acetylene in K, brings about a movement of the bell. The latter, which is balanced exactly, takes up its position of equilibrium when the pressure acting on its bottom face is equal to that acting on its upper face—that is to say, whatever be the variation in the conduit G or in the acetylene conduit K, the regulator always gives, above the parabolic valve M, a pressure equal to that in the main conduit G in front of the diaphragm H.

The regulator for ensuring the mixing of the two fluids in a given and constant proportion can also be arranged in the shunt on a main conduit G (fig. 2) and used for regulating the volume supplied by the branch K, so that the volume in question should be always in proportion to that passing through the main conduit G. The apparatus working in these conditions and having a counting device Q arranged in front or behind it, enables the volume supplied by a conduit G to be determined by measuring only a small fraction of the volume, and therefore using a measuring apparatus of only small capacity.

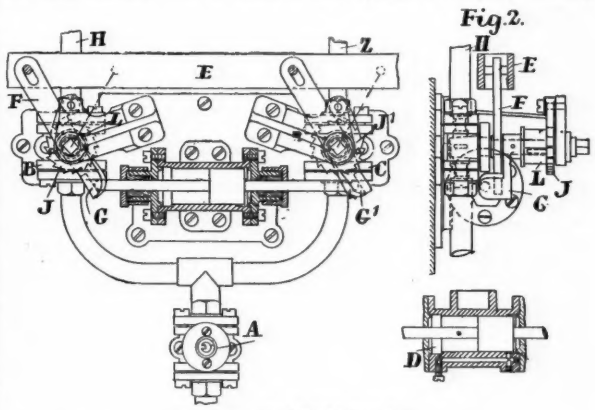
In the arrangement in fig. 2, the diaphragms H and R have for their object to bring about in the main conduit G the loss of head required for producing a current of fluid in the shunt conduit K and ensuring the working of the regulator and of the counting device Q. The regulator, instead of being provided with an oscillating bell A, could be constituted with a flexible diaphragm or a vertically adjustable bell, like those of emission regulators used in gas-works. The oscillating bell has, however, the patentees observe, the advantages of being very sensitive and easy to balance by means of a balance weight.

Alternately Igniting and Extinguishing Pilot Lights and Main Burners of Gas-Lamps.

JULIUS PINTSCH AKTIENGESELLSCHAFT, of Berlin.

No. 30,136; Dec. 28, 1910. Date claimed under International Convention, Dec. 27, 1909.

According to this invention, two separate cocks are provided—one for the supply pipe of the pilot lights, and the other for the supply pipe to the main burners—one of which is fully opened by hand by shifting



Pintsch's Pilot Light Regulator.

the device from one operative position to the other in order to establish the flow of gas from the source to the desired branch pipe. By this movement of the one cock, the tap of the other cock is released so as to enable it to be gradually closed automatically under control of a retarding device common to both cocks.

The illustration shows a plan (partly in section) of the whole device;

a side elevation and a longitudinal section of the retarding device. The mechanism consists essentially of a main cock A; a cock B for the main burner pipe H; a cock C for the pilot lights pipe Z; a retarding cylinder D; and an actuating bar E. The latter is positively connected with two levers F F^1 mounted freely on the spindles of the plug taps of the cocks B C. When the bar is moved in one direction, the levers abut against projections of the levers G G^1, which are fixed on the spindles of the cocks B C and are urged by springs L, which are arranged to be set by means of ratchet wheels J J^1 and co-operating pawls. The springs L are designed to close the cocks B C, which are so arranged that their closed positions are in different phases. For instance, both cocks are opened when the taps are turned towards the retarding cylinder D, which is provided with a duct communicating with both ends of the cylinder, the cross section of which duct may be varied by a screw.

The operation of the device is as follows: The actuating bar E is shown in the position which puts the device to "off." In this position, the gas enters from the main cock A through the supply pipe and cock C to the pilot lights pipe Z. The cock B controlling the main burner supply pipe H is closed, so that only the pilot lights connected with the pipe Z are burning. If, now, the bar E is put to the position corresponding to "on," the cock B is at once opened by means of the levers F G, whereas the lever F^1 merely releases the projection of the lever G^1, so that for the time being the cock C remains in the open position. The gas is now flowing through the cock B to the main burner supply pipe H; and, consequently, the air in this pipe is expelled, so that the burners connected with it are gradually ignited by the burning pilot lights.

Under the force of the spring L, the lever G^1 presses against the end of the rod of the piston of the retarding cylinder D in the effort to close the cock C. The latter, however, cannot be closed suddenly owing to the resistance of the air pressure in front of the piston; and consequently the complete closing of the cock C, and with it the extinguishing of the pilot lights, is delayed until the piston has expelled the air from the space in front of it to the space behind the piston. The cross section of the duct being variable by means of the screw shown, it is possible to retard the closing of the cock C so as to ensure that the burners on the main burner supply pipe H are ignited independently of their number or the distance of the lamps from each other.

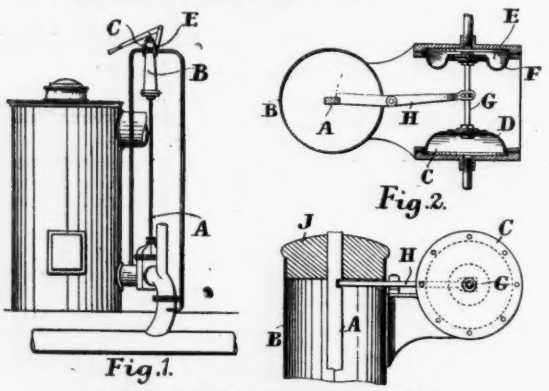
On the other hand, if it is desired that the pilot lights should be ignited at the main burners and the latter should be extinguished, the bar E is again put to the position corresponding to "off." In this case, the cock C is immediately opened to the full extent by means of the levers F^1 G^1, while the lever F merely releases the lever G. Sudden closure of the cock B, which, as well as the cock C, is subject to the action of the spring L, is prevented by the piston of the retarding cylinder D abutting against the projection of the lever G. On reversal of the bar E, both cocks B C are open, and the complete closure of the cock B takes place only when the piston has reached such a position that the projection of the lever G again abuts against the tail of the lever F.

Water-Gas Apparatus.

STELFOX, J. C., of Victoria Street, Westminster.

No. 29,709; Dec. 21, 1910.

The object of this invention is to prevent the opening of the blast-valves of water-gas apparatus if the pressure of the air in the blast-main be below that of the gas in the generating apparatus or below some fixed relation to the latter, and thus to prevent the passage of gas into the blast-main, and the consequent formation of an explosive mixture in this main or in the machinery room.



Stelfox's Water-Gas Blast-Valve Operator.

The blast-valves of the apparatus are controlled by a locking device actuated by differences in the pressures in the generating apparatus and the blast-main. In one arrangement, the blast-main at the inlet of the blast-valve and the gas-generating apparatus at the outlet of the blast-valve are connected respectively to two chambers separated by a flexible diaphragm, so that any excess pressure in either chamber over the other causes the diaphragm to move (or preferably to two separate chambers each having its own diaphragm, the two diaphragms being connected as by a bar). The diaphragms may be proportioned so as to move with any desired difference between the blast and gas pressures. This movement causes the bar or some connected lever to move in a slot in the blast-valve spindle (or its operating rod) in such manner that the latter cannot be raised when the diaphragms are at one end of the stroke, but is free when the diaphragms are at the other end.

Fig. 1 is a view of part of a water-gas generating plant fitted with a blast-valve the opening of which is so controlled. Fig. 2 shows a sectional plan and an elevation of one form of the valve-locking device. A is the spindle or operating rod of a blast-valve; and B its guide or standard, of the usual type. C is the chamber connected to the gas-generating apparatus, with its diaphragm D. E is the second chamber connected to the blast-main, with its diaphragm F. The movement of these diaphragms, and the connecting bar G, actuates the lever H and causes it to enter a slot in the operating rod, when the pressure in the chamber C is higher than that in the chamber E or bears some fixed relation to it (according to the relative areas of the two diaphragms). The lever H lies close underneath some stop (as indicated by J), which prevents the rod A being raised when the lever H is in the slot. The movement of the diaphragms from the chamber E towards the chamber C, when the pressure in the chamber C falls to the required extent, carries the lever H clear of the rod A so that the latter is free to rise.

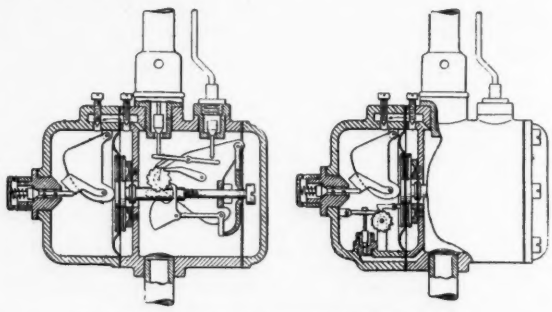
Controlling from a Distance the Valves of Gas-Burners.

ROSSBACH-ROUSSET, F., of Berlin.

No. 4936; Feb. 27, 1911. Date claimed under International Convention, March 19, 1910.

This apparatus for controlling from a distance the valves of gas-burners is of the type wherein, on a temporary and intentional increase in the gas pressure taking place, a diaphragm or yielding pressure member is moved so that mechanism is actuated to open or close the valve supplying gas to the burner. As is pointed out by the patentee, if such apparatus is to work efficiently it must be independent of any definite initial pressure, and not sensitive to gradual variations in gas pressure or rapid fluctuations in the pipes due to sudden gusts of wind. On the other hand, when a temporary intentional increase of pressure takes place, the apparatus must be certain to work.

Here one of two gas-chambers, separated from each other by a yielding pressure member—a diaphragm, piston, or the like—and connected to the gas supply pipe, is temporarily placed (as shown) in communication with the atmosphere through an outlet valve, opened by the movement of the yielding pressure member, when the burner-valve is to be operated; the outlet valve being closed as soon as the burner-valve has been actuated.



Rossbach-Rousset's Gas-Burner Valve-Controller.

As the diaphragm is generally exposed to gas pressure on both sides, and since the gas enters the two chambers through openings of different sizes, the ratchet mechanism is operated only when the pressure on one side of the diaphragm is rapidly and intentionally increased; and the initial pressure in the mains acting on the diaphragm is immaterial. As, moreover, the chambers on either side of the diaphragm are in free communication with the gas supply pipe, gradual changes of pressure are uniformly transmitted to both chambers, and, consequently, the diaphragm remains at rest.

Unintentional operation of the burner-valve when the gas pressure is momentarily increased and then quickly reduced—say, by a gust of wind—is almost entirely avoided, since the outlet valve does not immediately open to its full extent, and thus the pressure in the mains has time to sink before the gas pressure in one chamber has been sufficiently reduced to enable the diaphragm to operate the burner valve-actuating mechanism.

The operation of the valve-actuating mechanism, when a rapid and intentional increase of pressure takes place, is ensured by the diaphragm being relieved of pressure on one side when it is desired to actuate the burner-valve, so that practically the full gas pressure operates on the other side of the diaphragm to move the valve-actuating mechanism.

To avoid unintentional operation of the burner-valve when the pressure in the mains is momentarily increased, the chamber which has no outlet valve is connected to the gas supply pipe by a valve-controlled opening. If the valve is partially closed, the pressure is then only gradually transmitted to the chamber; so that a momentary increase of pressure does not influence the diaphragm which controls the valve-actuating mechanism.

When free movement is provided between the valve-operating gear and its actuating member, carried by the yielding pressure member, only a comparatively small but rapid increase of pressure is necessary to ensure its proper movement, since the excess of pressure on one side of the yielding pressure member, produced by the inlet openings to the two chambers being disposed on either side of the yielding pressure member and throttled to an unequal extent, only starts the movement of the diaphragm, while the operation of the valve is effected by the difference of pressure, which is increased as soon as the yielding pressure member is placed in communication with the atmosphere on the opening of the air valve.

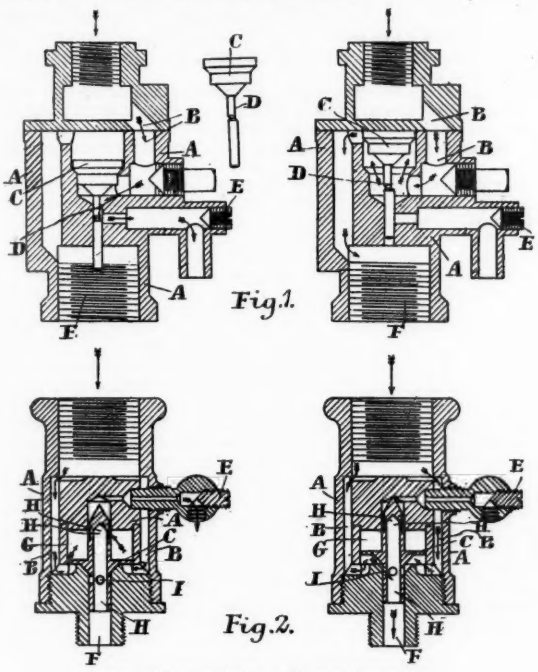
Two constructions of apparatus according to this invention are shown in longitudinal section.

Inverted Gas-Burners.

PERRY, W. F., of Tipton.

No. 28,523; Dec. 8, 1910.

This invention relates to inverted gas-burners with a controlling device of the mushroom type, to the underside of which gas is fed and which is so arranged that when the gas is at full pressure the valve is lifted off its seating, cutting off the pilot light supply and passing gas to the main burner; while when the pressure is reduced, the valve returns to its seating and cuts off the main burner supply, then only passing gas to the pilot light or bye-pass burner.



Perry's Inverted Gas-Burner Controller.

Fig. 1 is a longitudinal section of one form of lighter with the valve in the position for supplying the pilot light, and in position for supplying the main burners. Fig. 2 shows another form.

In fig. 1, the main chamber A is between the controlling valve and burner; the supply pipe being connected to the upper end, from which the gas passes, by the passage B, to the valve chamber beneath the mushroom valve C. When the quantity of gas is insufficient to lift the valve, the gas escapes from the chamber by the port D, which is formed by cutting away the valve stem for a portion of its depth. From this port the gas passes to the pilot light of the burner, a regulating plug E being provided in this passage. When more gas is admitted than the pilot pipe will pass, it lifts the valve C off its seating and allows the gas to escape to the outlet F to supply the main burners. The port D only extending over a short part of the valve stem. Immediately the valve is lifted, the reduced portion is raised and thereby automatically cuts off the bye-pass, or reduces the gas supply to it when the main burner is supplied.

In the modified form of lighter shown in fig. 2, the gas is similarly admitted to a valve chamber, which in this case is merely an annular groove beneath the valve C. This valve (a loose fit) allows sufficient gas to supply the pilot lighter to escape around its periphery to an upper chamber G having a passage to the pilot light. At full pressure the valve is lifted; the upper or coned end of the tubular stem H then entering a recess and reducing the pressure of gas to the pilot light. When the valve is lifted, openings I in the lower portion of the tubular stem are raised above the valve-seating; and through these openings and tubular stem the gas reaches the main burners.

The lighter is said to be particularly useful in churches or public buildings, railway stations, or in works, as for controlling burners above moving cranes, or where a large number of burners are supplied from a single main pipe in which it is desirable to light the main burners from a distance, "for by manipulation of a single master tap or controlling valve fitted with a bye-pass a large number of burners may be lighted."

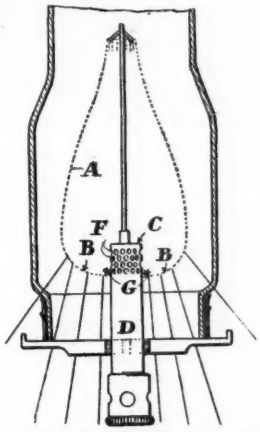
Incandescent Lamps and Mantles.

SKRIWAN, E., of Vienna.

No. 3026; Feb. 6, 1911. Date claimed under International Convention, Feb. 17, 1910.

Upright incandescent lamps, the patentee points out, suffer from the disadvantage that "the rays of light projected downwards by the mantle have either no effect or else very little effect, so that beneath the burner a small or large shadow is formed." A further disadvantage is that "the lower portion of the mantle which surrounds the burner-head fairly closely (apart from the fact that it is wholly useless for lighting purposes), on the lacquer being heated, adheres very firmly to the end of the burner-head, and the changes in dilation produced by the heating and cooling cannot take place. In consequence, the mantle becomes broken. If such adhesion, however, does not take place, then the disadvantage appears that, on variations in the length of the mantle produced by heating and cooling, the mantle becomes worn at the point of contact with the burner-head, and is thus quickly destroyed."

The object of this invention is to produce an upright incandescent lamp, which, like an inverted lamp, will "project downwards a large number of rays," by making a particular form of mantle which at its lower end, when in operative position surrounding the burner, is contracted in such wise that it forms an annular end, which in operation can also be contacted by the flame, and is thereby rendered incandescent and throws its rays of light downwards.



An Upright Incandescent Mantle Lamp of Novel Form.

The mantle A at the lower end encloses the burner, and is made as wide as possible, but is contracted at the lower edge in such wise that it forms an annular end B bearing on the burner-head C or on the burner-pipe D. By this means the mantle receives an addition B to its surface. In other respects it may be of any form; the additional surface connecting the space between the burner-pipe or burner-head, and the portion of the mantle projecting from this and assuming "a more or less flat or downwardly bulging form."

If this part of the mantle is subjected to the action of a heating flame, it becomes incandescent; and in consequence of its position relatively to the burner axis, all the rays emanating from it are directed downwards, so that the surface directly beneath the burner, in spite of the upright arrangement of the mantle, is "intensely and uniformly brightly illuminated as in inverted lamps."

In the form illustrated, the burner-pipe is closed at the upper end, and has in its cover one or more rows of outlet orifices, through which the gas and air mixture passes in the form of radial streams. Gas may also pass in an upward direction from the burner. In particular, the mixture, or the flame from it, passing from the lower openings F, strikes the contracted portion B of the mantle from the inside or outside or from both directions, and "produces intense incandescence of the mantle."

Direct Recovery of Ammonium Sulphate from Coke-Oven or Retort Gas.

FABRY, R., of Sheffield.

No. 5667; March 7, 1911.

This invention relates to the process described in patent No. 4473 of 1910—see "JOURNAL," Vol. CXII., p. 52.

The patentee says he has found it difficult to oxidize zinc sulphide into zinc sulphate by the method there described without losing appreciable quantities of sulphur escaping in the form of sulphurous acid. Furthermore, the oxidation of the zinc sulphide is never complete, so that the final product of the oxidation always consists of a mixture of zinc sulphate, zinc sulphite, and zinc oxide—a mixture unsuitable to recover simultaneously from the coal gas under treatment the whole of the ammonia contained in it together with so much sulphur as is capable of forming enough sulphuric acid to completely neutralize the recovered ammonia.

The object of the present invention is, therefore, a process or combination of known means for the purpose of converting quantitatively the zinc sulphide resulting from the washing of the coal gas with a solution of neutral zinc sulphate, into an equivalent quantity of zinc sulphate, which is then available for further washing the coal gas. This object is obtained in the following manner.

From the neutral or slightly acid solution of ammonium sulphate, obtained by washing the coal gas with a solution of zinc sulphate, the zinc sulphide is separated (by settling, filtration, or any other suitable method) and run regularly, and preferably in the form of mud, into a lead-lined closed vessel in which a regulated quantity of sulphuric acid is also flowing. The following reaction takes place:—

$$H_2SO_4 + ZnS = SO_4Zn + H_2S.$$

The zinc sulphate so formed is led back into the gas-washer for further use, while the sulphuretted hydrogen evolved is burnt with a suitable quantity of air, and the resulting products of combustion converted into sulphuric acid, preferably by the well-known contact process.

The chamber process may also be used; but owing to the purity of the sulphuretted hydrogen and its products of combustion, and the possibility of working the contact process on a small scale, the latter will, it is said, in most cases, be the more advantageous.

The sulphuric acid produced is utilized to form further quantities of zinc sulphate and sulphuretted hydrogen. The zinc sulphate may be conveyed to the gas-washer either as a solution or as a salt, according to whether or not sufficient water is added to the sulphuric acid to prevent crystallization of the zinc sulphate resulting from the combination of the zinc sulphide and the sulphuric acid.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Uses of High-Pressure Gas for Industrial Purposes.

SIR,—I quite agree with you that much of the utility of the discussion on the Institution papers will be lost if the authors neglect to reply except through the "Transactions." The only difficulty I see is that the discussion might be endless. More time should be allowed for discussion at the annual meeting. This could be obtained either by sectionalizing (as you suggest) or by authors of papers reading a short *résumé* of what they have compiled. The interest taken in my hurriedly-written paper more than justifies an immediate reply through the Press.

Mr. Jacques Abady concludes his letter with a note of regret that the tone I adopted seemed to suggest an unfortunate consciousness of superior knowledge. I most strongly protest that a gentleman of Mr. Abady's standing should feel it necessary to make such a statement, especially after he has read the opening paragraph of the paper. The least he can do from that point of view is to pass the same judgment on my paper as he would expect to receive on his own, and allow much for one's style of expression. I am happy to think the large majority of those who were good enough to comment personally on the paper have received it in the spirit in which it was written.

The criticisms may be divided into two classes—those in which misunderstanding has occurred, due, in the main, to an insufficiency of explanation as to the object of the experiment, and those in which the critics have come to different conclusions to myself on various points, as a result of their own experiments.

My object in publishing the results of a certain number of comparative experiments in the paper was by no means to show what a high-pressure appliance could do, compared with the best types of other appliances, but to show what a high-pressure appliance could do compared with the appliances and methods most generally employed in the application under consideration for the time being. That is what one has to contend with when advocating the use of any system.

As an example, brass can be melted by means of coke in a certain special kind of furnace at a cost which prohibits all competition from gas, on fuel costs alone. But compared with the general type of coke-furnace, gas at 1s. 3d. compares quite favourably, taking everything into account, with coke; and gas-furnaces are gradually being adopted for certain kinds of brass casting.

The gold melting experiment is another example of what I mean. In Birmingham, by far the majority of small jewellers use small crucible furnaces, fitted with air-blast burners, for melting up their gold scrap and lemmel. They consider that they do not do sufficient melting to justify their putting in an air-compressor, and, consequently, they, almost universally, use foot-bellows. A boy does the "bellowing," and a man attends to the melting; their wages usually being 4½d. and 9d. per hour respectively. The large consumption of gas in the air-blast experiment compared with the high-pressure gas will be easily understood by anyone who has endeavoured to heat-up a crucible by this means (low-pressure gas and air bellows). A low-pressure gas-furnace would prove more efficient for the purpose. The figures for melting by means of coke and air-blast are from actual jewellers' practice, and have been most carefully obtained.

It has been pointed out that the efficiency of the furnaces employed for gold melting was very low. I quite agree—the fuel efficiency is low. The jeweller or the brass caster (or the annealer or the aluminium melter) does not take up gas as a fuel solely because its efficiency is high. It is a much more important concern for him that the time of operation shall be reduced. Time is money; and it is no consolation to him to learn that by means of gas he is going to obtain a high fuel efficiency, if labour costs and everything else are going to be correspondingly increased. The time factor is a much more important one than the fuel factor, from the consumer's point of view. It is almost unnecessary to say that if the fuel efficiency can be increased, and other conditions remain the same, it is to the advantage of the consumer.

Mr. Mansfield raised the point, in his first letter, concerning the method I employed for measuring gas at varying pressures. I quite agree that coal gas is not a perfect gas; and for this reason the method of standardizing jets, as described in my paper, was adopted. The gas was measured at 20-10ths, by means of an accurate low-pressure meter, compressed by means of a compressor, and passed through standard jets at varying pressures, taken before the jets. All critics will agree that however much the gas varied from a perfect gas, the same weight of gas that passed through the meter per hour would pass through the jet, unless condensation of some of its constituents occurred. At these pressures, no appreciable condensation has been observed, and the calorific value has not varied more than within the experimental error.

I cannot gather, in comparing Mr. Mansfield's two letters, what point exactly he raises. I believe he raises two points—(*a*) that contained in his first letter, in which he asks whether, in the water-boiling experiment, I had reduced both gas volumes to 20-10ths, and then goes on to say that if I had not done so the high-pressure gas would contain 50 per cent. more B.Th.U. per unit volume than the low-pressure gas—813 B.Th.U., compared with 542. I replied that both volumes were reduced to the same standard; a cubic foot of either containing 542 B.Th.U.

In his second letter, Mr. Mansfield says that I have not replied to his original question, and suggests that, coal gas not being a perfect gas (with which I quite agree), it will have a different volume at low pressure after having been subjected to pressure than it had before compression. Taking his first letter again, does he suggest that the simple act of compressing to 15 inches mercury and expansion to the original pressure will make a difference of 50 per cent. in its volume? Surely the first point is the one he originally raised.

This point was also raised by Mr. Grafton; and Mr. Hartley asks how the gas was measured. I hope it is now clear.

The consumption pressure curve in the appendix should read "Consumption (Measured at 20-10ths Water) Cubic Feet per Hour."

I am asked by Mr. Abady whether I have ever seen two jets exactly alike. Under a microscope, certainly not. I have seen them so much alike that when water has been run through them from a constant head over a long period, and measured, there has been an error of less than 1 per cent. These jets are drilled with Morse drills, accurate to 1-1000th of an inch. As they are 1-20th inch thick, there is a sufficient bearing-surface to prevent side-play when in the lathe.

The jets used experimentally are polished on their inner surface by turning them at a high speed on slow tapered needles. For subsequent measurements of the jets, a blackened needle is used, and measured from the mark by means of a micrometer. The needles are guaranteed round to five places. An infinitesimal unevenness in the size of the jet is very much less than other sources of experimental error, however carefully the work is carried out. The jets are constantly being checked against low-pressure meters, through which the gas is passed before compression.

Mr. Abady asks why I advocate the use of standardized jets in place of meters before the gas is compressed. For experimental purposes, I have found the jets to be the more accurate. For consumers' use, jets are not convenient, although I hear that in Calcutta the gas is measured by a jet.

The water-heating experiment was carried out at the request of one of our Birmingham consumers, who used a very large number of glue-pots heated by means of low-pressure gas. The ring-burner he used was similar in design and construction to the large number of ring-burners I have noticed in use here. Before and since, I have found that it was not the best type of burner; but my object at the time was to determine its efficiency, in conjunction with the outer shell of a glue-pot containing water. This outer shell was lagged in a simple manner; the same pot and lagging being used in both cases. The question of lagging does not affect the comparison.

It is quite superfluous for Mr. Abady to introduce the question of the increased radiation losses in the case of the low-pressure test, and ask why this was not included in the calculations. There must be a reason for the difference in efficiency between the two methods; and I venture to suggest that the difference in temperature between the two flames accounts for the much increased efficiency. The greater the head of heat (temperature), the larger will be the percentage of heat passing through the iron to the water. In a low-pressure ring-burner of the type used, although the flames were fairly sharp before the pot was placed over the burner, when the pot was put in position, in contact with the tip of the flames, the products of combustion interfered with the proper aëration of the flames, and instead of the flames burning in contact with the iron pot, they were separated from it by a thin film of products of combustion, and the pot was obtaining its heat by means of hot products and radiation from the flame—probably no more than 10 per cent. In the case of the high-pressure burner, the high velocity of the combusting gases helped to clear away the products from the base of the pot, and, owing to almost complete aëration, the high-pressure flames were steady, and not drawn out through lack of air.

I have never seen a commercial ring-burner for low-pressure gas which would not light-back when aërated to the same extent as the high-pressure flames.

The experiments on water-heating are frequently being repeated; and, under the same conditions, they give the same results.

Mr. Grafton's tests are, no doubt, absolutely correct for the conditions under which they were carried out; and they served his special purpose at the time. In the experiment I took, there was a rise of 87° C. in one case, and 85° C. in the other. The water in either case was just short of boiling.

Mr. Hartley finds the water-boiling tests valueless to him. They were not intended to be of academic utility, but to fulfil the purpose I have indicated.

Mr. Grafton asks what I consider to be a "correct flame" for use in gas-fires having columnar fuel. I believe that the flame should have a slightly hazy inner cone—such that if the aëration were increased very slightly, the flame would become noisy, and the inner cone distinct. I gave as my opinion that all burners should be capable, by adjustment, of being caused to light-back or give a luminous flame. While the working pressures and the quality of the gas in different areas vary, it will be absolutely necessary to arrange for a wide range of adjustment in gas-stove burners. I do not wish it to be thought that I advocate that when a fire is installed its adjustment should be such that it would light-back. Far from it. In what tests I made with gas-fire burners, I found that the chief defect in some burners was that they had an insufficient range of adjustment.

Mr. Mansfield asks whether I have measured gas, compressed it, let the gas escape into a holder, taken its calorific value, and also measured the resultant volume of gas in the holder. All this has been done; and so far as the experiments indicated to the contrary, at the pressure at which we were working, the coal gas behaved as a perfect gas.

Concerning the high-pressure furnace burner used in the laboratory here, Mr. Abady asks how I know the quantity of air injected in the various high-pressure burners. By the analysis of the mixture of air and gas, of course, after they have passed through the burner. It is hardly necessary, however, to make an analysis, as by varying the pressures while the mixture of air and gas is burning in a crucible furnace, flame can be caused to appear at the sight-hole of the furnace by increasing the pressure when using all the high-pressure burners having expansion tubes. I see Mr. Mansfield agrees with me on the point that the amount of air drawn in does not vary as the pressure, in most high-pressure burners. An important series of tests on this subject are nearing completion; and I propose to publish them later.

Mr. Mansfield states that he has collected a large mass of data, all of which leads him into a *cul-de-sac*. Now, although much of his work is inconclusive (and much valuable research work always is), I should consider it a privilege if Mr. Mansfield would consent to exchange views privately on a number of points of mutual interest. And if the work of either of us thereby becomes more conclusive, it can be published and become of general use. It is, perhaps, asking too much, however, as my experience of the subject dates back but a short time.

The term "initial temperature of combustion" is an ambiguous one,

as it might easily be taken as meaning the ignition-point of the gas. When gas and air are undergoing chemical action and combining, radiant energy is being evolved, and is immediately dissipated throughout the flame and to the surrounding atmosphere. The temperature of the combusting gases (the flame) will depend on the extent to which this energy is concentrated in the form of heat in the flame. Concentration is brought about by various means. Dr. Bone told us in Glasgow that Mr. D. L. Chapman, of Oxford, had calculated that the temperature in the explosion wave of a mixture of electrolytic gas fired by adiabatic compression is 4265° C. The better the mixture of gas and air before combustion takes place, the higher will the flame temperature be. The larger the flame (the aëration remaining relatively the same), the higher will the flame temperature be.

Mr. Hartley waxes severe in the last paragraph of his letter, apparently labouring under a misapprehension as to my attitude towards the subject of heating by means of high-pressure gas. I am of the opinion that, compared with air-blast, there is nothing wonderful in it, as such. Any advantages it has (and in its use, I believe, there are many) are due purely to the mechanical conveniences in its use.

When using air-blast and low-pressure gas, one is dependent on two variable pressures, each of which is independent of the other. If the consumer compresses his own gas in preference to compressing air, he requires a smaller compressor, and smaller mains for the gas, than he does for the air; and no second main is necessary where compressed gas is used. Temperatures are more even in high-pressure furnaces than in air-blast furnaces.

We in Birmingham, over any given experiment, are getting generally quite as good results by means of air-blast as with high-pressure gas, so far as temperature and fuel efficiencies are concerned. The chief advantage of high-pressure gas is that by its means a good mixture of gas and air can be injected into a furnace by the simplest means, and be under perfect control.

It is quite possible that there are still some minor points unexplained or unanswered. In the main, I believe I have dealt with all the useful points raised. Discussions in the Technical Press on such subjects as these are of enormous value, and not the least to those who are carrying on work intimately connected with them. They will increase in value the more the personal element is kept out of them. This should not be a difficult thing to accomplish. You might be given a free hand, Sir, to use your blue pencil on matters and allusions which are not relevant to the subject under discussion.

I must say that from what I have read of recent discussions, both in the Technical Press and meeting, I have not looked forward to joining in either. I know there are many really useful contributions lying on shelves now, simply because the authors dislike joining in discussions which they believe will inevitably develop into a wholesale "rag," or worse.

E. W. Smith.

High-Pressure Gas Laboratory, Birmingham, July 15, 1911.

We have received from Mr. Jacques Abady the following reply to the above letter.

Sir,—Mr. E. W. Smith, in his letter of July 12, has replied to some of the questions put to him, and has given some explanations. I do not think the explanations strengthen the points urged by him in his original communication; and if I may be permitted a small amount of space, I will endeavour to briefly state why.

Measurement of Gas.—I do not agree with Mr. Smith that the use of jets in the manner he advocates is an accurate method of measuring gas—firstly, because jets vary in size, even with care in manufacture; secondly, because they are liable to obstruction from various deposits; and, thirdly, because gas varies materially in gravity from hour to hour and day to day. The latter fact, of course, destroys the value of a test of a jet with water.

The experiments upon jets with which I have been concerned range over so many years, and the results have been so consistently unsatisfactory, that I feel I can state, not as an opinion but as a fact, that the measurement of gas by jets is absolutely inaccurate. You measure gravity by a jet, not volume. Mr. Smith's statement that Calcutta gas is measured by jet would be a rather neat debating society point if it were true. But it is not.

Iron-Pot Test.—What Mr. Smith states in his paragraph commencing "it is quite superfluous," seems to me to complete the destructiveness of the criticisms which have been levelled at this test. A consideration of the time element (which affects the radiation to a great extent), so far from being superfluous, is all-important. To show that this is so, I think it will be found that if, instead of such an amount of gas at low pressure being used as would take 8½ minutes, the quantity were increased in order to halve the duration of the test, then the result would be vastly different.

I do not think the way in which Mr. Smith now states he used the low-pressure burners would meet with the approval of many burner makers.

I quite agree with Mr. Smith when he says: "There must be a reason for the difference in efficiency between the two methods." The reason is that Mr. Smith is comparing two sets of non-comparable conditions; and his tests are tests of methods, and not of the relative efficiency of gas used under high and low pressure respectively. To put it in another way, if I were a maker of high-pressure apparatus, and wished to give the buying public a glowing idea of the value of my apparatus, I should make a test like Mr. Smith made it. If I wanted to arrive at the truth, however, I should not.

Measurement of Air.—Mr. Smith says he arrived at this "by the analysis of the mixture of air and gas, of course." All I have to say to this is that I totally disagree with this method of measurement, because I do not think it possible to get accurate figures from it; and if Mr. Smith will carefully think over the matter, I believe he will see that the use of the method is by no means a matter "of course."

As to the general question of the relative efficiency of gas used under high and low pressure, it is my belief that greater efficiency follows increased pressure to a certain extent; and I have before expressed the opinion that pressure as well as volume should be a factor in fixing price. It will be obvious, however, that the lower the calorific standard becomes generally, the less will be the increased efficiency due to increased pressure. In any case, the iron-pot figures do not represent, or even approach, the relative values.

Jacques Abady.

Westminster Palace Gardens, S.W., July 15, 1911.

Corrosion of Service-Pipes.

Sir,—In his letter published in your last issue, Mr. Hole says "one cannot be altogether incorrect in speaking of an ash subsoil as 'acidiferous' in character."

Surely if such ash subsoils give an alkaline reaction, and as I have previously stated this has been my experience so far as these soils have been examined by me, it follows that the term "acidiferous" applied to an alkaline body is entirely misleading. The mere fact that the porosity of such ash subsoils permits access of air and moisture containing traces of carbonic acid does not render the subsoil acid or acidiferous in character.

In my notes I have recorded certain observations I have made which may be right only in the case of the samples examined by me. If so, Mr. Hole will be able, I have no doubt, to supply or instance cases opposite to my conclusions. For example, it is open to him to test whether ash subsoils do or do not give an alkaline reaction. I have only to add that in my previous letter to you I did not define acidiferous subsoil in the way stated by Mr. Hole.

James M'Leod.

Greenock, July 12, 1911.

Oxide Firing in Purifiers.

Sir,—The purpose of Mr. Townsend's interesting letter as to oxide firing in purifiers was to suggest a method whereby boxes might be changed and emptied with safety.

The desired end would appear at Wakefield to be obtained by making for (say) twenty-four hours the foul box take the last place in the series; and it is claimed that, following the regular admission of a small percentage of air into the purifiers while at work, further revivification *in situ* is effected during the period mentioned, to such an extent as to avoid danger and nuisance.

It is obvious that where a second set of boxes is not available for check purposes, the backward and forward rotation principle cannot be well applied. In cases, too, where purifiers are comparatively small, the Wakefield results are not obtainable.

I would suggest that the desired minimization of danger may be achieved by shutting off and allowing the foul purifier to remain unopened for (say) a day, in order to dissipate any heat which may have been generated during working. This is the plan adopted here, and, as a further precaution, steam is passed into the box for two or three hours prior to shutting off.

I am inclined to think that the Wakefield method of placing the foul box last for a short time is another way of allowing it a chance of cooling should this have been necessary, since chemical action virtually ceases with the passage of clean gas through the vessel.

It would be useful to have expressions of opinion from those who have had and overcome purifier troubles, since the subject has attained importance, and has, I understand, induced the Home Office to ask for suggestions in the matter generally.

Robt. Watson.

Doncaster, July 13, 1911.

Sir,—The letter of Mr. H. Townsend on the above subject is of very great interest and importance at the present time; and I hope that engineers who have been troubled with "firing" in the purifiers will publish full particulars. These particulars, if tabulated, will go a long way towards solving the cause of the trouble, and providing us with a preventive.

While I cannot agree with Mr. Townsend that the passing of purified gas through oxide containing 50 per cent. of sulphur has any tendency to prevent firing, yet the method is good, and worth following, from the fact that the purifier is found to be less objectionable to work in by the men who have the emptying to do. At the same time, I find that when oxide is worked up to 50 per cent. or over without changing, it is not so objectionable to work among as when it contains only 30 to 40 per cent.

Last October, I emptied a 20 ft. by 20 ft. box that was filled with new natural oxide (held in hurdle grids) in July, 1909. When emptied, it was found to contain 68 per cent. sulphur, dry basis, and was like a bed of concrete. This when taken out showed no sign of heating, and gave off very little odour. While the oxide was at work, I used varying percentages of oxygen, in experimenting to ascertain the maximum that could be used without affecting the calorific or candle power of the gas; but at no time was there the slightest sign of overheating.

It would be interesting if those who have had trouble would state whether the oxide was natural or artificial, as up to the present my inquiries and investigations on the behaviour of oxides of iron as purifying agents point to the fact that any oxide that is in a fine state of division, and which quickly absorbs sulphuretted hydrogen, has a tendency to quickly oxidize; and when this occurs, it may be exceedingly difficult to prevent overheating and firing on opening a box, if the contents are anywhere about 30 to 40 per cent. sulphur. I can quite understand that, with oxide in this condition, firing may take place in the purifier itself, if from any cause an excess of oxygen is admitted.

I trust that the letter of Mr. Townsend will open up a correspondence that may help to solve what is undoubtedly a serious problem.

W. C. Jones.

Brierley Hill, July 15, 1911.

Unfounded Allegation of Fish Poisoning by Tar.—A paragraph appeared in the "Journal" for the 4th inst. (p. 43) to the effect that a considerable area of the main road in the Kirkby Stephen district had been recently tarred to settle the dust, but that subsequent drenching rain had washed the tar into the River Eden, where numbers of trout had been found poisoned; and concern was felt by the farmers on the banks of the Eden lest their cattle should also be poisoned. We are, however, now given to understand that there was no ground whatever for the statements as to fish having been found poisoned by tar,

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Margam Urban District Council Bill, Rotherham Corporation Bill.

Bills read the third time and passed: Chasetown Gas Bill, Gas Orders Confirmation Bills (Nos. 1 and 3), Marple Urban District Council Gas Bill, Rhondda Urban District Council Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read the first time and referred to the Examiners: Gas Orders Confirmation Bills (Nos. 1 and 3), Rhondda Urban District Council Bill.

Lords Bill read a second time and committed: Merthyr Tydfil Corporation Water Bill.

Bills reported with amendments: Kingston-upon-Hull Corporation Bill [Lords], St. Helens Corporation Bill.

Lords Bills read the third time and passed: Chapel, Whaley, and District Gas Bill, Sidmouth Gas and Electricity Bill.

Petitions against the Merthyr Tydfil Corporation Water Bill have been presented by the Barry Urban District Council, the Llandaff and St. Mellon's Rural District Councils, the Glamorgan County Council, and the Pontypridd and Rhondda Joint Water Board.

UXBRIDGE GAS ORDER.

House of Lords Committee.

(*Before Lord* WELBY, *Chairman, Marquis of* EXETER, *Lord* SACKVILLE, *Lord* BARING, *and Lord* ROTHERHAM.)

The Bill for the confirmation of a Provisional Order issued by the Board of Trade for the extension of the limits of supply of the Uxbridge Gas Company came before the above Committee last Thursday and Friday.

Mr. C. C. HUTCHINSON, K.C., and Mr. A. M. PADDON appeared for the promoters; Mr. BALFOUR BROWNE, K.C., Mr. TYLDESLEY JONES, and Mr. C. HALSEY represented the Hertfordshire County Council, who petitioned against the Bill.

Mr. HUTCHINSON, in opening for the promoters, said the only petition against the Bill was that of the Hertfordshire County Council, who asked for a special clause for the protection of their roads and bridges. The Uxbridge Gas Company were constituted under an Act of 1861, and were authorized to supply certain populous places in the county of Middlesex, and also in the county of Buckingham. This was followed by the Act of 1873, which extended the limits of supply and authorized the raising of additional capital. The object of the present Order was to further extend the limits of supply by taking in a number of parishes, including Chenies, Amersham, Penn, Great and Little Missenden in the county of Buckingham, and the parishes of Flaunden and Sarratt in the county of Hertford. The Hertfordshire County Council had withheld their assent to the Bill owing to the refusal of the promoters to insert a special clause giving protection to the roads and bridges under the control of the Council. When a gas company were laying pipes and mains, it was necessary, under the Gas-Works Clauses Act of 1847, which was incorporated in the Order, to comply with certain conditions. These conditions would, of course, be complied with. The two parishes of Flaunden and Sarratt were quite rural districts, and required no protection beyond what was contained in the Gas-Works Clauses Act. The promoters agreed to put in the Bill the clause inserted for the protection of the County of Middlesex in 1906—to give them, in fact, the same protection as Middlesex had had for the last five years. The county of Buckingham accepted the clause as sufficient; but the county of Hertford wanted something more, and asked for the insertion of what was known as the steam-roller clause. They asked for something in addition to the existing law.

The CHAIRMAN: I understand the Bill contains a clause extending to the Hertfordshire County Council the same protection as is afforded to the Middlesex County Council; so that the Hertfordshire County Council stands in relation to the Bill in exactly the same position as the Middlesex County Council?

Mr. HUTCHINSON: That is so.

The CHAIRMAN: Do we understand that the Middlesex County Council have consented to the provisions of the Order?

Mr. HUTCHINSON: The Middlesex County Council are not affected by the Order; but in the county of Buckingham we have taken in a large area, and they are satisfied.

The CHAIRMAN: Does the county of Hertford stand in exactly the same position as the county of Buckingham?

Mr. HUTCHINSON: Not one word of difference, except that they are much less affected.

Mr. *H. E. Jones* was called and gave formal proof of the preamble.

In cross-examination by Mr. TYLDESLEY JONES, witness said, having regard to modern traffic, he should advocate the laying of mains 2 feet below the surface. On roads on which steam-rollers were used, he might go lower if the road had a bad foundation. He was quite willing to be put under the provisions of the General Act; but he objected to the steam-roller clause. He was willing that sub-section 5 of section 54 should not apply to the county of Hertford. So far as the gas-mains under roads were concerned, he was willing to remain under the General Act.

This was the case for the promoters.

Mr. BALFOUR BROWNE then called

Mr. *E. H. Stevenson*, who said in the two parishes proposed to be taken into the Uxbridge limit of supply there was a considerable length of main road which was not now subject to any interference by a gas company. The County Council had a perfect right to send their steam-rollers over these roads without any restriction as to weight, so long as they did not break down the bridges.

Mr. BALFOUR BROWNE: The Uxbridge Gas Company seek to get powers to lay pipes along these roads. Do you think it is fair that they should prevent the Local Authority repairing the roads in the same way they have been in the habit of doing in the past?

Witness: It is perfectly fair for the petitioners to say you shall not prevent us using any roller suitable for our purpose.

In cross-examination by Mr. HUTCHINSON, witness admitted that in his experience the steam-roller clause had never been inserted in a Bill before Parliament, except by consent. He could not say that it had frequently been asked for and always refused.

Mr. *Herbert Smith*, the County Surveyor to the Hertfordshire County Council, said there were about 12 miles of main roads in the two parishes of Flaunden and Sarratt. The Council asked for the steam-roller clause in the interests of the ratepayers of Hertfordshire.

The Committee then adjourned. On the resumption of the proceedings the following day,

Mr. BALFOUR BROWNE proceeded to address the Committee on behalf of the Hertfordshire County Council. He said reference had been made to a clause which the County Council desired to have inserted. The clause began by saying that, notwithstanding anything contained in the Order, the following provisions for the protection of the County Council of Hertfordshire shall, unless otherwise agreed between the undertakers and the County Council, have effect. The only paragraph he proposed to read was the first one, because paragraphs 2 and 3 were practically accepted by the witness for the promoters yesterday. Paragraph 1 provided that: "The County Council shall not be liable to pay any compensation for any injury to any of the works of the undertakers, or any loss or damage which may be caused by, or arise out of, the reasonable exercise of any powers of usage for the time being vested in the County Council." The County Council had the control of the whole of the main roads in Hertfordshire vested in them. These roads were some 1200 miles in extent. The County Council had the duty put upon them by Parliament of maintaining, repairing, and renewing these roads. The clause went on to say that "if the County Council, as the road authority, use a steam-roller not exceeding 20 tons in weight, it shall not be deemed to be an unreasonable exercise of such power of usage." This alone was the part complained of. The roads now had been made up and maintained by means of steam-rollers. A witness told the Committee that his steam-roller, unloaded, weighed 12½ tons; but when they hired a steam-roller, it weighed not less than 15 tons. It was a matter of common knowledge that the weight of these steam-rollers was constantly increasing; and he asked their Lordships to say that it was not an unreasonable exercise of their power that they should be allowed to use steam-rollers if the weight did not exceed 20 tons. Here were the County Council in sole possession of the roads—there was nobody there except themselves. But now the Gas Company came into their district and became partners with the County Council in the roads. If the Council did them any injury, it was their own fault—they should lay their pipes in such a way that they would not be injured by the use of a steam-roller, even if it weighed 20 tons. Was it reasonable that the ratepayers of Hertfordshire should be called upon to pay for any injury done to the property of the Gas Company under these circumstances? They were not interested in the Company. The only people interested were the gas consumers and the Gas Company themselves. They were coming into the county now for the first time, and were trying to prevent the County Council making reasonable use of a steam-roller of from 15 to 20 tons in weight. The Council were only carrying out their duties to the ratepayers when they said, if any damage were done, the responsibility should not be cast upon them so long as they were only carrying out their functions in a reasonable way.

Mr. PADDON replied on behalf of the promoters, and asked their Lordships not to insert the clause. Under the General Law, the County Council had already complete and ample protection. When the Gas Company proposed to lay mains along these roads, they had to submit plans to the County Council; and if they were not satisfactory, they could go to the Justices and get the plans altered if it were found that the complaint was a reasonable one. This clause was the most absolute derogative and destructive of the Company's common law rights.

The room was then cleared; and on the parties being re-admitted,

The CHAIRMAN said the Committee passed the Order without the opposed portion of the clause asked for by the Hertfordshire County Council.

BUSBY AND DISTRICT GAS ORDER.

House of Lords Committee.

(*Before Lord* WELBY, *Chairman, Marquis of* EXETER, *Lord* SACKVILLE, *Lord* BASING, *and Lord* ROTHERHAM.)

The above Order, which is comprised in the Gas Orders Confirmation (No. 4) Bill, was before the above Committee last week. The Order empowered the Busby and District Gas Company, Limited, to maintain and continue on a statutory basis their existing gas-works in the parishes of Cathcart and Mearns, and to supply gas within part of the parish of Mearns and parts of the parishes of East Kilbride and Carmunnock, all adjacent to the boundaries of the City of Glasgow. The Corporation of Glasgow petitioned against the Bill, asking the Committee so to restrict the Company's area of supply as to allow the Corporation the opportunity of extending their mains into that part of the parish of Mearns to supply which the Company would require to carry their pipes about two miles. The Corporation pointed out in

their petition that they already had mains laid close to the disputed area.

Mr. JOHN WILSON, K.C., and Mr. KING appeared both for the Busby Gas Company and for Lanarkshire County Council (which supported the Order); Mr. BALFOUR BROWNE, K.C., Mr. HONORATUS LLOYD, K.C., and Mr. HAROLD BEVERIDGE represented the Glasgow Corporation; and Mr. CLODE appeared on behalf of the Renfrewshire County Council.

Mr. WILSON said he did not understand any real or legitimate interest that the Corporation of Glasgow had in opposing the Order, though they might suspect an ulterior motive. The Busby Company grew out of a small gas-works carried on many years ago by a Mr. Crumm. He contended that the petition disclosed no *locus standi*. The Corporation had no statutory or other authority to supply gas within any part of the limits of the Order, and as a matter of fact they were not supplying to any person within the area. The Order interfered with no property of the Corporation, and in no way altered their rights or privileges or injuriously affected their present position. The limits of the Order did not include any portion of the Corporation's limits for the supply of gas; and he submitted they were not entitled to be heard. He quoted the Draycott case as a precedent.

Mr. BALFOUR BROWNE argued that the Corporation were entitled to be heard. It was true that they had no statutory authority to supply gas in the area in question; neither had the Company. They were both exactly in the same position. Neither the Corporation nor the Company were supplying gas in the area. What he submitted was that the Order interfered with an understanding and arrangement which was made in an agreement relative to the purchase by the Corporation of the Company's works in Giffnock. Under this agreement, it was determined that the Corporation should continue to supply gas to the parish of Mearns; and he submitted that this agreement gave the Corporation *locus*. The price of the Corporation gas was 2s. 2d. per 1000 cubic feet in the city supply district, and 3s. in the supplemental area. In the district in question, there were people who, if they got gas from the Company, would have to pay 4s. 7d. per 1000 cubic feet. He had authority to pledge the Corporation that they would come in and supply the whole of this area with gas in the immediate future when they were authorized to do so.

The Committee expressed the opinion that the Corporation were entitled to be heard; and evidence was called.

Mr. *Brown*, the Manager of the Busby Gas Company, stated that an extension of the Company's system in the parish of Mearns would be to the public interest in the whole area supplied by the Company, as increased consumption would allow a reduction of price all round.

Mr. *Alex. Yuill*, the Gas Engineer to the Dundee Corporation, stated that the gasholders and plant generally belonging to the Company were in good condition. He believed the plant was capable of producing four times the present output.

Mr. *Alex. Wilson*, the Gas Engineer to the Glasgow Corporation, was called in support of the Corporation's petition, and stated that they were prepared to put in mains in the disputed area without any guarantee whatever.

At this stage, the Committee adjourned. When the proceedings were resumed on the following day,

The CHAIRMAN intimated that the Committee did not desire to hear any evidence on behalf of the Glasgow Corporation.

Mr. WILSON, addressing the Committee on behalf of the promoters, said there could be very little doubt that the Busby Gas Company had been subject to a considerable amount of oppression on the part of the Glasgow Corporation. They first of all made a good bargain with the Company for the sum of £9000; and since then the Company had had to fight for every inch of territory which remained to them. The Corporation, having made an agreement with his client, proceeded to do a rather extraordinary thing. They applied to Parliament for confirmation of a Provisional Order giving them the whole of the remaining territory within the radius of what is known as the "yellow triangle," which it was said the Busby Gas Company had agreed to hand over to them. As a matter of fact, the agreement was never concluded. This point was made quite clear before the Committee of the House of Commons. Through long and weary years, and at considerable expense, the Busby Gas Company, who were the pioneers in the district, had built up a nice little business; and now it was proposed that Glasgow should come and take it away from them. He submitted that the Company, who had done good service to the community, were entitled to have this service recognized. If their Lordships allowed Glasgow to come into their area, as they were claiming to do, they would charge 3s. per 1000 cubic feet within 1300 yards of the Busby Gas-Works. What was to become of the remainder of the area and of the gas-works, which were capable of producing millions of cubic feet of gas as soon as the resources of the locality were developed? If the Committee passed the Bill, Glasgow would be able to come into the Busby area and would supply gas at 3s. where the Company were now charging 4s. 7d. If this profitable area were taken out, it would not be possible to continue the charge at 4s. 7d.—it might probably go up to 5s. for the remainder of the area. If they agreed to the Glasgow proposal, they would hand over to the Corporation the most profitable portion of the Busby area. Glasgow already had a population of 800,000 people within its own area, and a large supplementary district of supply outside the city. Were all these people to be charged a higher price for gas in order that Glasgow might undersell the Busby Company and inflict injury on the remainder of the householders in the counties of Renfrew and Lanark who resided within the Busby area? So long as Glasgow got this "yellow triangle," which was going to be quickly developed, they did not care what became of the non-developing area. He submitted that the Glasgow proposal contained an injustice to Busby, and would be unfair to the rest of the community in Lanark and Renfrew.

Mr. CLODE, on behalf of the Renfrew County Council, called

Mr. *G. Duncan*, a member of the Council, who stated that he had been authorized by the Parliamentary Committee to give evidence against the suggestion to include the proposed triangular portion of the parish of Mearns in the Glasgow area of supply. The County Council were satisfied that it was in the interests of Mearns parish as a whole that it should remain in the area of the Busby Gas Company.

In cross-examination by Mr. HONORATUS LLOYD, witness said he desired to see a supply of gas in the parish of Mearns. He believed the Busby Company's mains were about two miles from the triangular portion. The Glasgow mains were within a few yards of the triangle; and the cost of extending them would be infinitesimal.

Mr. HONORATUS LLOYD: Do you think it is in the public interest that people should be supplied with gas at 3s. per 1000 cubic feet or at 4s. 7d.?

Witness: It would be in the interests of the people in this particular locality that they should be supplied at 3s.; but I am thinking of the interests of the community as a whole. It would be better that the Busby Company should be allowed to supply gas to the area which is likely to develop first, in order that they may be in a position to supply other parts of the district.

Mr. WILSON addressed the Committee on behalf of the Lanarkshire County Council, who petitioned against alterations.

The room was then cleared. When the parties were re-admitted,

The CHAIRMAN said: The Committee consider that the Order may proceed provided a clause be inserted to the effect that the triangle shall not be within the Company's limits if the Glasgow Corporation, in the session of 1912, obtain powers to supply the district.

MILFORD HAVEN GAS ORDER.

The Bill embodying the Milford Haven District Council Order (*ante*, p. 112) was again before the Chairman of Ways and Means Committee on Unopposed Bills last Thursday. Mr. EMMOTT presided.

Consideration of the Order had been adjourned in relation to the provision in which the Council were given, subject to the sanction of the Local Government Board, unlimited borrowing powers for their gas undertaking. The Committee indicated on the former occasion that they were not prepared to assent to the provision, as it kept the Local Authority beyond the control of Parliament. They adjourned the proceedings in order that further information might be supplied by the Local Government Board relative to the insertion of the provision.

Mr. WOOD, of the Local Government Board, submitted a statement setting forth many precedents (both Bills and Provisional Orders) for the provision. He argued that, in the event of there being any complaints against the administration of the undertaking, these would be duly noted by the Inspector who conducted the local inquiry, and, if advisable, reported upon with the view of influencing the amount to be sanctioned.

Mr. MOONEY (a member of the Committee) pointed out that the tendency of the Local Government Board in recent years had been in the direction of deciding, upon their own responsibility, the extent of borrowing powers in cases such as this.

The CHAIRMAN observed that the Committee did not desire to do anything which would compel a local authority to come to Parliament every three or four years; neither did they wish to encourage a system which enabled a local authority to keep away from Parliament for a long period.

Mr. WOOD suggested that the Committee might let the Bill through, and consider the whole question next session.

The CHAIRMAN: Certainly not. Our attention has been called to it now, and we must deal with it.

The Committee finally inserted the figure of £12,000; this being based upon an estimated requirement of £4000 to £5000 for five years.

LEGAL INTELLIGENCE.

THE PIPE CONTRACT DISPUTE AT LINCOLN.

In the Nisi Prius Court at Lincoln Castle last week, the important action arising out of the new water-works scheme of the Lincoln Corporation [*ante*, p. 113] was continued before Mr. E. J. POLLOCK, one of the Official Referees of the Supreme Court. Plaintiffs, the Staveley Coal and Iron Company, Limited, claimed from the Corporation a sum of £15,778, under a contract, of which the total was £28,406, to supply cast-iron pipes for the main in connection with the new supply of water. The Corporation said the pipes which were the subject of the claim were some which had been rejected, but had been re-numbered and sent back having been passed; and they made a counterclaim of the same amount as the Company's claim.

Sir EDWARD CARSON, K.C., M.P., Mr. NORMAN CRAIG, K.C., M.P., and Mr. LYNDEN MACASSEY (instructed by Messrs. Davis, Sanders, and Swanwich, of Chesterfield, appeared for the Company; Mr. HUGO YOUNG, K.C., and Mr. J. B. MATTHEWS (instructed by Mr. W. T. Page, Town Clerk of Lincoln) represented the Corporation.

Fourth Day.

On the resumption of the proceedings on the 8th inst.—the fourth day of the case—Mr. Gandy's cross-examination was continued.

Witness was questioned by Mr. HUGO YOUNG with reference to certain entries in one of the plaintiffs' books in regard to a particular pipe. He admitted that an "R" (rejected) had been altered to a "W" (waste), and that there was a note at the side which read: "Spongy spigot-end." The entry in the books of the Corporation in respect of this pipe was "R," and there was a note: "Spigot faked." Counsel reminded witness that Mr. Westlake had stated that 455 of the rejected pipes were taken into stock; and he asked him if he could state the actual number. Witness replied that he could not give an estimate; but he understood 455 were paid for to the casters.

Mr. HUGO YOUNG: May I take it that the total payments to the casters include the 3862 pipes passed and the 455, and that is all?

Witness: No, Sir, that is not all. We make them allowances, and give a sort of "subs" in addition.

Then it is impossible to get from you the amount you have paid to the casters for this job, and specifically what it is for?—Certainly.

Witness was then taken through an arithmetical calculation with the object of showing what was the loss to the Company upon a "waster" pipe in comparison with the profit accruing to them if it passed the Inspector and went forward to the Corporation depôt. Witness informed the Court that the cost of material and workmanship was 25s. per ton; and each pipe weighed, on an average, 1¼ tons. According to the contract, they had from the Corporation £5 6s. 7d. per pipe, less 8s. 7d. for carriage, or £4 18s. If they broke the pipe up, all they got was the actual cost of the iron (£3 2s. 6d. per pipe) and the difference between that £3 2s. 6d. and £4 18s. was the loss to the Company—£1 15s. 6d. Counsel next reverted to the conversation which the witness had with Mr. Smith during the interview at the works on the 21st of March, when, as witness had stated in his examination-in-chief, Smith (who had gone to the works for the Corporation as a practical moulder) told him he laughed at the idea that these numbers could be burnt on the pipes. Witness said he had not made any memorandum of the conversation; but it was so strange that he was not likely to forget it. The peculiarities of terminal figures was the next matter to engage attention. It was pointed out by Counsel that the groups of figures ending with "8" and "6" came up for inspection before those ending with "3" and "5;" and witness said his attention had been called to this.

Mr. Hugo Young: You agree that if I am right in the suggestion that there was a practice of altering the figures "8" and "6" into "3" and "5," this would be a necessary incident of that practice?

Witness: Yes, it would. But I cannot explain it.

Now have you found the same thing does not apply in dealing with other terminal numbers?—I have not looked into it.

Have you made observation that on a number of these pipes, where the terminal figure is "3" or "5," you find there has been some work done on the final figure; and that on the corresponding number of "8" and "6" you find very frequently something abnormal about all the figures on the pipe? Has your investigation drawn this to your attention?—No, Sir.

Irrespective of who has done it, I ask you whether you noticed that the "3" and "5" terminal figures have been abnormal, and that in the same numbers, except ending with "8" and "6," all the figures appear now somewhat abnormal?—I have not noticed that.

Have you noticed at the spigot end of some of the pipes there is a depression?—Yes.

What I want to ask you is, have you noticed that it is nearly always on a number ending with the terminal figure "3" or "5"?—I have not observed that.

In further cross-examination, witness said that he had not observed certain other peculiarities in the figures pointed out by Counsel. He had not particularly noticed that the figures which had been chiselled and filed were "3" and "5;" but it was quite possible that they should have more done to them at the fettling-bench. Witness was next questioned in regard to discrepancies in the weights marked on certain pipes and their actual weights. In one case a pipe bearing a particular number according to the pump-book was marked as weighing 1 ton 4 cwt. 2 qrs. 14 lbs.; but the pipe which actually went forward under the number was 1 cwt. 6 lbs. greater weight. Counsel wished to have this explained. Witness said he could not do it; he supposed it was due to carelessness. Asked if he could account for this—that the Inspector had passed a pipe with a particular number on it, and made a note of a special characteristic, but that the pipe delivered under the number had not this characteristic, witness replied in the negative. Two specific instances of this were quoted; and witness was unable to account for them.

Fifth Day.

On the re-assembling of the Court on Monday last week,

Sir Edward Carson said that, under the order of the Official Referee, the defendants had furnished the plaintiffs with a list of cases in which they said rejected pipes had had the numbers fraudulently cut. This was one branch of the case. There was another, under which they said the terminal figures had been altered. Having regard to the number of pipes, their expert witnesses could not complete their evidence without a list of these cases, and they wished to have them investigated if defendants would give the numbers they relied on.

Mr. Hugo Young said this appeared to be quite reasonable, and he did not see any difficulty in doing it. The only thing was that a great many of the pipes where the terminals of what they called the "father" had been altered, were now underground. To meet the exigencies of the pipe-laying contract, they were used; but a list of them was kept, and they knew exactly where they were. They could easily supply the list of those on the surface.

It was arranged that the list should be supplied.

Sir Edward Carson then said he was told the pipes were being constantly moved about, and he wanted them to be left as they were. The plaintiffs' engineers had to go out and turn their attention to these various matters as they arose in evidence, and they found the pipes displaced and discoloured with mud.

Mr. Hugo Young said the pipes had only been moved as a matter of convenience. They had been put into consecutive order, so that it might be known where to find them. If Sir Edward did not want them to be moved, they should not be. He added that Mr. Barron wished to go over to Staveley to see "the three pipes" after the rising of the Court. He supposed Sir Edward had no objection to him seeing any other pipes on the ground, if he wished.

Sir Edward Carson: Not the least.

Mr. *Gantry* was then further cross-examined on a few points.

In re-examination by Sir Edward Carson, witness said he had stated, with respect to the non-production of the three pipes required on the occasion of Mr. Barron's visit, that he himself saw them the next morning, and examined them. No question was subsequently asked by the Corporation authorities as to whether or not the pipes had been found. A number of questions had been put to him by Counsel for the defendants as to the passing of "8" pipes before "3" pipes, and he was asked by Sir Edward whether any selection was made in this way. Witness's reply was: "None whatever." He added that he never gave any directions to have the pipes brought up in any particular order, and he never heard that they were. Counsel said he wished to give instances on the theory the defendants put forward of "8" being turned into "3" and the pipes delivered. He wanted to take cases where the former pipes were taken before the latter, so as to show that it was not an invariable practice. Witness was taken through a series of instances where the state of things quoted by Sir Edward was shown to exist.

Mr. Hugo Young said he had not limited himself to stating that the only alterations were in the figures "8" and "3" and "5" and "6;" but he had laid special stress on these.

James Allright, the foreman in charge of the pipe dipping and forwarding department at the Staveley works, explained at some length what was done with the pipes after they had passed the Inspector. He said the pipes that had been rejected were sent to a different place altogether from that to which the good pipes went; the latter being put into trucks, and taken to the dipping-tank. When the pipes were actually sent away, the number of the truck into which they were put was taken from one of the books, and entered in the despatch-book, which was kept by the advice clerk, who entered the matter in the advice-book. Witness was questioned by Sir Edward Carson as to what took place on the day when Mr. Barron and Mr. Richardson appeared at the works and asked for three particular pipes. Witness said he went to look at his man's book. He saw the number of the pipes; but they were not ticked off. There were other numbers not ticked off. He and Smith then went on to the sidings and climbed into about a dozen waggons without finding the pipes. As it was dinner time, and there was another mile to walk, they stopped the search. On his return to the works, he saw Mr. Barron, who was very violent, and accused witness or knowing all about the job. He went about the search for the pipes as fast as he could, so as to find them and get the job done as soon as possible.

In cross-examination by Mr. Hugo Young, witness said he did not consult the book in which he could have seen for himself where the several pipes could have been found, as it was kept by his assistant for private use.

James Taylor, assistant to the last witness, was next called. After giving evidence as to the procedure in the works, he said he did not find the three pipes Mr. Barron asked for on the 21st of March, but did so next morning. He spent about three hours in looking for them on the afternoon of the 21st; but he did not find them, because they were not ticked off in his book. They never ticked off pipes when they were going into stock. He found them in two waggons, and reported it to Mr. Allright, who went along with him in order to see them.

Sixth Day.

Mr. *W. J. E. Binnie*, of the firm of Sir Alexander Binnie, Son, and Deacon, examined by Mr. Norman Craig, said that for the purposes of the case he had examined in detail he believed every pipe which had been challenged by the defendants, and also those remaining at the plaintiffs' works. He had measured the thickness of the pipes at both the spigot and the socket end; and he gave in great detail a mass of figures relative to each pipe, of which the number was mentioned by Counsel. He showed the variations in the thickness of the metal of the pipes at each end, and gave the height of the relief of the number figures above the body of the pipe. He was furnishing these particulars when the Court rose for the midday adjournment.

On re-assembling after luncheon,

The Official Referee commented upon the method which had been adopted of going through the long list of pipes and their measurements; and it was agreed that a list should be provided, including those which remained to be dealt with.

In answer to further questions, witness dealt generally with the results of his examination of the pipes. He said the plaintiffs' Solicitor (Mr. Sanders) had asked the other side what they had been doing with the pipes; and the reply was that a vaseline and blacking mixture had been applied to them. He added that the coating would have the effect of concealing evidence if anybody came to inspect the pipes. He had seen the particulars of the action, and knew that in regard to the pipes complained of as defective, the only particulars given were that each of them possessed one or more of 23 different defects which a pipe might present. A good many of the pipes had the appearance which suggested that work had been done on them over and above what he called legitimate fettling; but a large number did not look as if they had had the work of a fettler at all. They were very amateurish. The terminal numbers, if they happened to be "3" or "5," were mostly uncovered, having been covered and then worked up again with white paint on them. Dealing specifically with numbers, witness said a "5" was so different from a "6" that an alteration could not have been made; and this feature was preserved throughout the different blocks used. Some of the suggested alterations were more than could be accomplished by a fraudulent person. In the vast majority of cases, they could not say whether or not an "8" had been altered into a "3;" but there was evidence indicating why a particular "3" had not been altered from an "8." There were difficulties in the way of making the alterations suggested. With regard to the thickness of the pipes, witness said he did not expect to find it uniform, either right round or right through. The variations he had given earlier in the day were nothing out of the ordinary in measuring cast-iron pipes with great accuracy. Having given a good deal of detailed evidence as to the particular appearances of certain pipes which he had examined for marks, witness produced a chisel which he said he found inside one of the pipes at No. 5 depôt on the 11th of June. He said it was a chisel which might have made the sort of marks he saw; but it was not the kind of tool which would be used to alter numbers, or anything of that kind. It was not a fettler's tool.

Mr. Hugo Young pointed out that the chisel did not appear to have been used, judging from both the head and the point.

Witness agreed that it had not been used much, but said it might have been used a little.

Withdrawal of the Plaintiffs' Case.

On the resumption of the hearing on Wednesday morning,

Sir EDWARD CARSON intimated that he had a statement to make in reference to the case. He said certain knowledge came to hand on the previous day which had satisfied Mr. Westlake, the Managing-Director of the Staveley Company, that the Company ought not to further contest the right of the defendants to have the contract terminated. The moment Mr. Westlake ascertained that there were reasons for supposing that the pipes had been improperly dealt with, he did not hesitate for a moment to instruct him (Sir Edward) to this effect. So far as the Company were aware, and having regard to the satisfactory way in which all other contracts were being carried on at the same time, it was thought impossible that this could have happened. But Mr. Westlake was now satisfied that he was deceived, and that some persons—though it might be difficult to trace who they were—were tempted, by reason of the unprecedented number of rejections in the Lincoln case, being about 30 per cent., compared with 2½ per cent. in the other contracts, to try to dispose of rejected pipes by tampering with them. The arrangements they had come to were these: That plaintiffs were to take back, at their own expense, all pipes at present at the Corporation depôts, or any pipes that had not been used; that the defendants should pay for all pipes they had actually used, at the contract price; that the plaintiffs were to abandon any further claim under the contract; and that the defendants under the counterclaim should receive £3000, and upon this the plaintiffs were to be relieved from any further liabilities under the contract. Counsel added that, of course, it followed that the plaintiffs were to pay all the defendants' costs on the claim and counterclaim. The Referee would probably make an order that the sum paid into Court should be handed over to the defendants.

Mr. HUGO YOUNG said he was not at all surprised that the Staveley Company should have taken this course, which, he thought, was most creditable to them under the circumstances. He quite agreed that the Company was one that stood very high; and, in his cross-examination of the Managing-Director, he said he felt sure that if Mr. Westlake was once satisfied that fraud had been committed, he and his Company would be the first to try to put the Lincoln Corporation right. On behalf of the Corporation, he (Mr. Young) could only say it was very gratifying to them that their conduct had been so fully justified.

The OFFICIAL REFEREE also congratulated both parties and everybody concerned on the result. He said it was one which he considered very satisfactory to everybody, because the case involved an enormous amount of expense. Unfortunately, somebody or some persons—for whom, so far as he could see, the Staveley Company were in no way responsible morally, though they were legally, inasmuch as they were carrying out the contract—committed some gross fraud, which entitled the Lincoln Corporation to determine the contract. He could only say he thought Mr. Westlake had nothing whatever to do with the matter; and nobody, so far as he knew, connected with the Company, was aware of what was going on until somewhere about the 21st of March. He hoped there would be further investigation to arrive at the real facts; and he supposed some order or judgment would be required.

Mr. MATTHEWS suggested that the record be withdrawn upon these terms, with the Judge's order, if necessary.

The OFFICIAL REFEREE agreed.

The case, which had occupied the Court altogether eight days (including the day spent visiting the works), and had cost, according to a statement made by Sir EDWARD CARSON in the course of the proceedings, £3 10s. per minute, was then brought to a close.

Unlawfully Fixing a Gas-Pipe.

Charles Buckett, of No. 4, Hobart Place, Wokingham, was charged before the Magistrates of the town with unlawfully laying a pipe to convey gas to his house. According to the evidence given, defendant, in March, 1910, entered a cottage previously occupied by a tenant who was supplied with gas from the local Company. During three quarters of the year, no gas was registered by the meter; but 2s. was found in the slot-meter for two quarters of this year. As there appeared to be some irregularity, a fitter was sent to the house; and he discovered what had been done. When he disconnected the meter on the house side, he found a supply of gas coming back, which was altogether unusual. As he was leaving the place, defendant's wife called him back, and took him to the spot where the connection had been made. The gas went over the meter; and the work was done so cleverly that an ordinary person would not have discovered how it had been carried out. Later the defendant went to the Manager of the works, and asked him to hush the matter up. The full penalty of £5 was inflicted.

Position of the Newtown Gas Undertaking.—In the course of a lengthy report on the Newtown Gas-Works, Mr. William Belton, of Shrewsbury, who was called in by the Urban District Council to advise them as to putting the concern on a more profitable basis, said the works generally were in a fair condition, but the Council were not obtaining as much gas per ton as they ought to do. This appeared to him to be due, firstly, to want of adequate supervision in the retort-house; and, secondly, to stopped pipes. Under the present arrangement, it was impossible for the Gas Manager to devote sufficient time to the retort-house work and to the supervision of mains, services, meters, and lamps, which were all possible sources of leakage. Too much of his time was taken up in collecting rates, which necessitated his absence from the works to an undesirable extent, during which the retort work was not properly carried out. He advised that the collecting be removed from his duties; that the hydraulic mains be altered; and that the coal used be changed. The gas unaccounted for, equal to 11·5 per cent., was too high; and the Manager's time would be more profitably employed in detecting leakages than in collecting rates. The Gas Committee agreed to appoint a collector, to make the alterations to the hydraulic mains, and to reset two beds of retorts.

MISCELLANEOUS NEWS.

EUROPEAN GAS COMPANY, LIMITED.

Recent Labour Difficulties in France.

The Annual General Meeting of the Company was held on Tuesday last, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. R. HESKETH JONES in the chair.

The SECRETARY (Mr. W. B. Brady) read the notice convening the meeting, and then the following report of the Directors:

The Directors have pleasure in reporting an increase of 4¼ per cent. in the total gas-rental received during the year. With the exception of Bolbec, all the stations show a satisfactory improvement.

The cost of coals has been slightly higher than during the previous year, but under new contracts, which will shortly come into force, the price will be reduced. The average price realized for coke is a trifle below that obtained last year. Both tar and sulphate have given a higher return.

The Directors have succeeded in renewing the Company's concession at Bolbec, which has been extended 25 years, until 1949. The average length of the Company's concessions is now 27 years.

In view of the increasing demand for gas at Rouen, we have recently purchased additional land adjoining the Company's works in the Ile Lacroix. We have also acquired an additional slip of land at Sotteville, which is an adjunct to our Rouen works, and where there has recently been a considerable increase in the sale of gas, due no doubt largely to the reduction in the sale price agreed to on the extension of the concession last year.

The rearrangement of capital decided upon by the shareholders at the extraordinary general meeting held on Feb. 21, 1911, has been successfully carried through; and the Directors now recommend the payment of a dividend of 12s. 6d. per share, free of income-tax, on the augmented capital, which will be a total of 10 per cent. for the year, as foreshadowed by the Directors in their circular of Feb. 4 last. The payment of the above dividend of 12s. 6d. per share is, as usual, subject to a deduction for French stamp and transfer duty of 1s. 1d. per share in respect of all shares held in France.

The Directors purpose in future to equalize the half-yearly dividends by distributing 10s. per share each half year, instead of as heretofore paying a larger part of the year's dividend on Aug. 1.

Notice has been given that two Directors (H. C. Smith, Esq., and R. Hesketh Jones, Esq.), and both Auditors (J. Reeson, Esq., and H. J. Luff, Esq.) retire from office at this meeting, but, all being eligible, they offer themselves for re-election.

The CHAIRMAN, in moving the adoption of the report and accounts, said that since the last annual general meeting an unusual number of events had occurred in connection with the Company. They had had two extraordinary general meetings for the purpose of readjusting the share capital in relation to capital outlay, taking advantage of these meetings also to modernize the Articles of Association. All this had been carried out with much labour, careful study, and attention by their officials and staff in London, whose labours the Directors had recently acknowledged by suitable gratuities. He could not allow this opportunity to pass without, in the presence of the shareholders, very heartily thanking each member of the staff for the care, devotion, and attention to the work in which he had been engaged, and which had brought it to a successful completion. He (the Chairman) might mention that, during the past four months, the staff had not for many nights left the office until nine and ten o'clock at night; and he felt sure the shareholders would agree with him in conveying to them very hearty appreciation of their services. [Hear, hear.] Turning to less favourable events. For some months past, the Company had experienced labour troubles at some of the stations. The shareholders would no doubt from time to time have seen allusions in the public Press to strikes and threatened strikes in France. Commencing with the railways, the discontent spread, fostered by Labour Bureaux, with head quarters in Paris, and culminating, in their own case, in the stokers at Rouen striking, in conjunction with those at the French Gas Company's works in the town. The strike lasted for several days. Their Manager (M. Huon) obtained stokers from other gas-works; and with the assistance of the general staff, who remained loyal to the Company, he was enabled to maintain the supply of gas at Rouen, and not only so, but to assist, to a certain extent, the other Company as well. His actions were appreciated by the Mayor and local authorities; and the Directors had since acknowledged, by the grant of gratuities, his tactful services and those of the men and staff who remained faithful, and rendered him their services during the several anxious days preceding and during the strike. Several of the men who went out on strike had not been taken back into the Company's employ. These labour troubles had not been confined to Rouen. They created much anxiety for the Directors and Managers, who endeavoured to treat the men with all possible consideration and liberality. But, in consequence of outside pressure, the men were often forced to act contrary to their own interests. He was, however, pleased to say that the several mayors and local authorities with which the Company were connected, and with whom they endeavoured to co-operate, had, during these labour troubles, recognized the Company's actions; and it behoved him, as Chairman, on this occasion to tender to them their best thanks. He was sure the shareholders would agree with this. [Hear, hear.] In the Directors' report, they recommended the payment of a dividend of 12s. 6d. per share, which, with the interim dividends paid on Feb. 1, amounted to 10 per cent. per annum on the present share capital. This might perhaps require slight explanation. The old £7 10s. paid-up shares received 7s. 6d. per share last February. They would now receive 12s. 6d.—that was to say, 20s. for the year; being 10 per cent. on the now fully-paid shares of £10. Every three of the old fully-paid up shares of £10 that received in February 10s. per share—*i.e.*, 30s.—would now be paid 12s. 6d. per share on four shares—*i.e.*, 50s.—being a total of 80s. for the year, or 10 per cent. on a holding of four shares (£40). Before moving the adoption of the report, he might allude to the progress of the Company's business during the past ten years that he had had the honour of occupying the chair. In 1900-1, the consumption of gas was 1250 million cubic feet; in 1910-11 it had been 1587 million cubic feet. The

towns the Company supplied did not increase by leaps and bounds; but the business progressed steadily and satisfactorily.

The DEPUTY-CHAIRMAN (Mr. H. E. Jones), in seconding, remarked that, as the Chairman had fully explained, they had been passing through a period of considerable anxiety; but when they looked at their Chairman's bronzed and healthy face, they would see that it had not altogether worn him out.

The motion was unanimously carried.

The CHAIRMAN moved, and Mr. R. S. GARDINER seconded, the declaration of a dividend in the terms stated in the report.

Mr. H. D. ELLIS: Will you, instead of paying 12s. 6d. and 7s. 6d. per share, pay 10s. and 10s. on the same dates?

The CHAIRMAN replied in the affirmative.

The DEPUTY-CHAIRMAN proposed the re-election of the Chairman and Mr. H. C. Smith as Directors of the Company. Referring to the veteran Chairman, he said the shareholders had seen, from the terse and exhaustive account supplied to them of the transactions of the past twelve months—it was *multum in parvo*, the whole history of the Company at a very critical time had been given in brief compass—that they had a gentleman at the head of the Board who had a powerful grasp of all the Company's affairs, even under circumstances of great difficulty. Their Chairman had had a varied and ripe experience as a gas administrator, coupled with which he had a happy, genial, and fraternal manner with his colleagues, which rendered service by the Directors very pleasant, and harmonized and united them all. The history of any successful company must be written in the harmony and consistency of its Board. Mr. Smith was also a Director of several years' standing; and he had a complete acquaintance with all the circumstances of the Company. He gave very valuable help in the matter of the securities in which they invested their reserves, which were happily not unimportant in amount.

Mr. R. S. GARDINER seconded the motion, which was unanimously carried.

Moved by Mr. ELLIS, and seconded by Mr. L. R. WILKINSON, the Auditors (Mr. J. Reeson and Mr. H. J. Luff) were re-appointed.

SPECIAL ACKNOWLEDGMENT TO THE STAFF—AGITATION AND LOYALTY.

The CHAIRMAN remarked that he had already, in his address, practically proposed a vote of thanks to the Secretary (Mr. Brady) and the staff in London. Therefore it was not necessary for him to say more about them. But he should make special allusion to their friend the Managing-Director (Mr. W. Williams), upon whose shoulders had devolved, and from whose head had been evolved, the details as to the rearrangement of the capital, and the various duties which had been carried out by the staff during the last four or five months. Without the head, the tail could not very well move. [Laughter.] Therefore, he (the Chairman) had very much pleasure in specially referring to Mr. Williams. During the ten years that he (Mr. Jones) had had the pleasure of occupying the chair, he had worked harmoniously with Mr. Williams. Then as to the staff abroad, unfortunately, owing to his (the Chairman's) accident twelve months ago, he had not since been able to go abroad. Therefore he could not speak of the staff abroad so well as he could otherwise have done had he been in personal contact with them. But he had watched their movements. He had their correspondence before him pretty well every week; and he felt that he might say they had a most efficient staff. The accounts and reports from them were always carefully scrutinized; and when there was anything to which their attention should be called, it was always efficiently dealt with and carried out by them, and with the greatest satisfaction to the Board.

The DEPUTY-CHAIRMAN, in seconding, also spoke of the work of Mr. Williams, the Secretary (Mr. Brady), and those who worked under him. With respect to the officers and staffs abroad, he said he had always been impressed with the extreme care and anxious pains taken by their local Directors and engineers. They were all men of good education and standing, and most of them carried diplomas of some of the scientific and educational societies of France. One thing that one found was their particular anxiety in the interests of the shareholders, and their loyalty and devotion to the Company. They had especial exemplification of this in the conduct of their Managers who had lately been submitted to strikes and partial strikes. They had exercised great patience, forbearance, and conciliation. Fortunately, all their Managers stood so well with the Mayors and Corporations of the towns in which they worked, that when misunderstandings arose they were able to explain the position, and obtain the assistance of the municipal corporations. This was of great importance to the Company. Their workmen, too, had for the most part been exceptionally loyal, and not less so because the Company happened to be an alien one. It was very gratifying to see the allegiance these men had to their duty; and it was fair of him to say that the endeavour of the Board was always to treat the employees of every rank—from the highest to the lowest—in a just and generous spirit. The men appreciated this; and when they were upset—it was only part of them, he was very glad to say—by the agitators whose work it was to disseminate violence and discontent, the men, except a comparatively small portion of them, stood by the Company. During the recent trouble, though it was a time of anxiety, it was a satisfaction to the Board to find how many of the men were loyal. In connection with these times, the Board commended the attitude in which, and the manly courage with which, their Manager at Rouen (M. Huon) faced the difficulties. He bore himself like a man from first to last; and he conquered in the end, and in the end, too, was kind and merciful to those who returned to the Company. It was obvious, however, that all could not be taken back. The history of the strike in Rouen was one which would always be creditable to the Manager and staff of that station.

Mr. W. B. PRATT, from the shareholders' side of the table, supported the encomiums passed upon the staff by both Chairman and Deputy-Chairman.

The motion was heartily passed.

The MANAGING-DIRECTOR (Mr. W. Williams), in acknowledging the vote on behalf of himself, the Secretary, and his staff, and the Managers and their staffs abroad, said the words that had fallen from the Chairman and the Deputy-Chairman and the endorsement of the shareholders, showed that they had a due appreciation of the extra work that had devolved upon the officers and the staff for some time past. But it had all gone through satisfactorily; and the kind remarks that had been made on this occasion would be an encouragement in the future, and especially to those who had had to face difficulties of no common order in dealing with a situation set up and fomented in Paris, and not entirely dependent upon the will of their own men. The Directors treated their men liberally, and that so many of these men stood loyally by the Company, showed that the good treatment was not thrown away. The vote would be an encouragement to the officers and the men, and it would be highly appreciated by them.

Mr. ELLIS remarked that a vote of thanks was due to the Chairman and Directors, and most emphatically the shareholders should add a word of sympathy with them on account of the difficulties they had had to encounter during the past year. Nothing was more unsettling to a Board of Directors than labour troubles, because they did not know how far they might extend. He hoped that, in the immediate future, the Directors might be spared any recurrence of the recent experience. They could not, however, shut their eyes to the fact that labour disturbances on the Continent were becoming more frequent, and that European countries were in a serious condition in this respect; and France, he supposed, would have its share. They had these disputes forced upon employers and upon the men, who, in the case of this Company, were treated in a generous manner. This should persuade the men that it was against their interests to strike. He was sure the Board were magnanimous enough to meet the men with the utmost possible concessions, without showing weakness, which was always fatal.

Mr. J. REESON seconded the motion, which was very cordially agreed to.

The CHAIRMAN, in the course of his acknowledgment on behalf of himself and his colleagues, said, so long as he was spared, he should do his utmost in the interests of the Company. He was working with gentlemen who desired to spare him as much as possible the anxious duties which usually fell upon a Chairman, although he must confess that he did not like to shirk his duties at all. It was true the Board had had an anxious time the last few months; and he dare say they would have anxious times in the future. If any one had read the Paris notes in "The Times" that day, they would have seen that matters were by no means quiet in the House there. They must expect further agitation; but while the Board desired to be conciliatory to their men, they should endeavour to be firm, and not yield too much to pressure.

This concluded the proceedings.

EAST GREENWICH GAS-WORKS INSTITUTE.

Opening Ceremony.

The workmen employed at most of the stations of the South Metropolitan Gas Company have had the advantages of an institute in which to meet for recreation and social intercourse; those engaged at the East Greenwich works being until last Wednesday an exception to the rule. On the day named, however, a new building which has been erected for their use was formally opened and handed over by Mr. Charles Carpenter, Chairman of the Company. Its main feature is the hall, in which the ceremony was held. It will seat about 800; and nearly this number were present. It is well lighted, for both day and night use, and amply provided with exits. The floor, specially laid for dancing, is covered by a drugget. There is an ample stage, the opening of which is surmounted by a bust, in high relief, of the late Sir George Livesey; while at the rear are spacious rooms which may be used for purposes connected with entertainments or as committee-rooms. There is a billiard-room, affording space for two tables at least; also a miniature rifle range and a recreation-room in connection with a refreshment department; and the kitchen and lavatory arrangements are excellent. The employees themselves, working through a Committee already actively engaged, will take steps to provide the furnishing; but even in this matter help has been given by the Company in the shape of chairs and the drugget which preserves the smoothness of the floor of the large hall.

As mentioned, Mr. Carpenter presided at the opening ceremony; and upon the platform with him were Messrs. Frank Bush (the Vice-Chairman of the Company), J. Mews, J. Ewart, T. B. Hawksley, Frank H. Jones, and J. Newbold (Workmen-Director), Mr. H. Austin (a former Director), Mr. F. M'Leod (Secretary), Mr. W. Doig Gibb (Chief Engineer), Mr. J. F. Braidwood (Engineer at the West Greenwich works), and Mr. S. S. Field. The Chairman explained that, of the Company's different works, those at East Greenwich had been left so long in the matter of an institute, as it was felt that it was the most important, and experience had been gained by what had been done at the other works. He said the Directors' duty began and ended with providing the buildings. No pains had been spared with them; and it remained with the men to make the institute a success. That it would be done the Directors were confident. He declared the building open. Mr. Bush then gave some interesting reminiscences of the starting of the works at East Greenwich. Mr. J. Newbold, Mr. J. D. C. Hunter, Mr. W. H. Cupit (Workmen-Director) and Mr. Austin followed. Mr. Gibb informed the company that the building was really the Chairman's own design; and he read a letter from Mr. Joseph Tysoe (the Engineer-in-Charge of the station, who is on holiday) in which this credit was given. The institute was gratefully taken over by the staff, on the motion of Mr. W. S. Lawes, seconded by Mr. Sturt.

The terms submitted to the Weston-super-Mare Urban District Council by the Gas Company, for the lighting of the whole district as now lighted by gas, were £2045 per annum; whereas the amount paid by the Council under the last contract was £2175. The seal of the Council has been affixed to a new three years' contract with the Company.

GAS PROFITS AT CARLISLE.

The Carlisle Town Council, at their meeting last Tuesday, had placed before them the accounts of the gas undertaking for the twelve months ending March 31.

Mr. J. P. Buck, the Chairman of the Gas Committee, pointed out that the total amount of outstanding loans on the whole of the works, plant, mains, and meters was £24,201, to which they might add the balance of the suspense account, amounting to £2923, making a total liability of £27,124. The balance of the suspense account would, at the present rate of reduction, be extinct in three years; while the loans account, at the present rate of reduction, would be wiped out in nine years, leaving the whole of this valuable property—unless further loans were needed—entirely free from liability. This state of affairs was largely due to the policy adopted a year ago (whether wisely or justly, he would make no pronouncement) of increasing or renewing the property to a considerable extent out of revenue by building up a reserve fund. Of a total amount expended on works, plant, mains, and meters of £147,821, no less a sum than £78,763 had been provided out of revenue—thus demonstrating that the gas consumers of the city, besides paying large sums yearly to the relief of the city fund, had practically built up this huge undertaking. The position was sound, and the citizens of Carlisle were to be congratulated to-day on having such a property. They were not quite following this policy now, except in a small way. Last year, they asked the Council to place £500 to reserve. This year they were proposing that the amount should be increased to £1500, by placing £1000 to the fund. The results of the year's working, before capital charges, interest, and income-tax were deducted, amounted to the handsome sum of £14,020, which, he believed, was a record for the gas undertaking. It was a result which had not been obtained by sitting down and waiting for something to turn up. It was largely due, as he thought all would admit, to the energy, foresight, and intense interest in the success of the business manifested by their Engineer (Mr. Harold Bloor). Among the matters to which he drew attention on the expenditure side, was the repair and renewal of meters. No serious overhauling had been done for many years; and the Committee were as anxious that no one should pay too much as they were that no one should pay too little. Hence when they knew things were well with them, the Engineer decided to overhaul a section, and had it repaired and renewed, which had meant an increased expense under this head of £700. No work was more important, both from the Committee's and the consumers' point of view. He was given to understand that the amount of £33,917 on the revenue side of the balance-sheet was a record sum for gas-rental in any one year. He sincerely hoped that, with the increased facilities for using gas by cookers, &c., the quantity sold might be even larger still. The sales of coke and sulphate of ammonia were little different in amount from those of the previous year; but they obtained £450 more for tar. The two sides of the account balanced with the large sum to the credit of the gas-works of £14,020, which, after payment of instalments of loans and suspense account, together with interest and income-tax, left a net sum of £8695. The income-tax amounted to £700, or equal to very nearly 1d. per 1000 cubic feet. The Committee asked the Council to confirm their decision to place £1000 to reserve and £693 to pay the deficiency on the baths account, and to hand over the sum of £7000 to the city fund account. The past year had not been altogether a bed of roses; but he believed when they realized the honest aspiration of their Engineer and his Committee to safeguard the interests of the Council, while moving steadily in the path of progress, they might know each other better and sympathize with each other's difficulties.

Mr. King, alluding to the sum which was paid in income-tax, suggested that the question of reducing the price of gas might be taken into consideration.

Other members congratulated the Chairman of the Committee and the Engineer on the results achieved.

Mr. Buck, replying to the remarks made, said that, with regard to the price of gas, he considered they had better wait and see for a time.

OLDHAM CORPORATION GAS DEPARTMENT.

Annual Report of the General Manager.

The General Manager of the Gas Department of the Oldham Corporation (Mr. Arthur Andrew) has presented his annual report, which furnishes the following particulars.

The gross revenue for the past financial year amounts to £180,443, and the gross expenditure to £133,018; the balance carried to the profit and loss account being £47,425. The annuities amounted to £3348, the interest on loans and stock to £13,949, and the sums payable to the respective sinking funds, &c., to £6655—making £23,952; the net profit on the year's working being £23,473. Adding the balance brought forward (£19,158), and deducting the amounts transferred to the borough and reserve funds (£7500 and £6000), the cost of renewing the Higginshaw gasholder (£3342), and the amount written off for depreciation on gas cooking-stoves (£1650), making in all £18,492, there is left a credit balance of £24,139 to be carried forward. The prices realized for residual products were considerably higher last year than during the preceding twelve months—coke and breeze to the extent of 11½d. per ton, tar of 6s. 1¾d. per ton, and ammoniacal liquor of 8d. per 100 gallons of 10-oz. strength. The cost of production, apart from the increased value of residuals, decreased by 2d. per 1000 cubic feet, due principally to lessened expenditure for the repair and maintenance of works, and partly to a decrease in the cost of fuel and in carbonizing wages; the latter owing to there having been an increased make of gas per ton of coal carbonized. The cost of fixing cookers free during the year amounted to £1701.

The quantity of gas consumed by the street-lamps within the borough and in the various municipal buildings, formerly supplied gratuitously, was charged for last year, and included in the revenue, in accordance with the provisions of the Corporation Act of 1909.

The quantity of gas manufactured at the different stations during the year ended March 25 was: Oldham, 55,998,000 cubic feet; Higginshaw, 698,465,000 cubic feet; Hollinwood, 557,632,000 cubic feet; do. (water-gas plant), 142,408,000 cubic feet—total, 1,454,503,000 cubic feet, against 1,390,303,000 cubic feet in the preceding year; being an increase of 64,200,000 cubic feet, or 4·62 per cent. The following quantities of coal, oil, and benzol were used in its production: Coal, 109,829 tons 2½ cwt.; gas oil, 403,639 gallons; benzol, 87,909 gallons. The average quantity of coal gas made per ton of coal carbonized was 11,946 cubic feet, compared with 11,666 cubic feet in the year 1909-10. The quantity of gas unaccounted for was 78,138,000 cubic feet, or 5·37 per cent. of the quantity made, compared with 73,837,000 cubic feet, or 5·31 per cent., before. The maximum quantity of gas delivered in 24 hours was 7,718,000 cubic feet, on Dec. 15 last, compared with 7,609,000 cubic feet the previous year; being an increase of 109,000 cubic feet. The record maximum delivery was on Dec. 23, 1904—viz., 8,634,000 cubic feet. The minimum quantity delivered was 1,703,000 cubic feet on June 26, 1910, compared with 1,572,000 cubic feet before; being an increase of 131,000 cubic feet. The average illuminating power of the gas, No. 2 "Metropolitan" burner, was 19·89 candles.

The total number of meters fixed on the 25th of March last was 53,722, of which 4026 are of the prepayment type; 951 meters were fixed in new premises and others in which gas had not previously been used; and 115 meters were permanently disconnected. The actual number of consumers at the close of the financial year was 48,455. The number of meters fixed but not in use was 2264—a reduction of 137 during the year. The net increase in the number of additional cooking-stoves and grillers fixed free of charge to consumers was 1798. The total number in use on the 25th of March last was 18,876, exclusive of stoves owned by consumers. The number of gas-fires sold during the year was 52. There was an increase of 18,107,000 cubic feet in the quantity of gas used in houses and shops, and of 45,240,000 cubic feet in that consumed in mills and workshops; the latter increase being due to less short time having been worked in the mills than during the preceding year. The number of prepayment meters in use increased last year from 2662 to 4026; and the quantity of gas consumed through them from 18,299,000 to 35,702,400 cubic feet.

As recorded in the "Journal" at the time, the first sod of the new gasholder tank at Hollinwood was cut on Aug. 8, 1910, by the then Chairman of the Gas Committee, Alderman Jason Thompson, J.P. The holder will be of the spiral-guided type, in four lifts, with a capacity of about 5¼ million cubic feet. One of the two-lift gasholders erected in 1872 at Higginshaw has been replaced by one having four lifts, on the spiral-guided principle. The new holder was brought into use on Nov. 7 last. [See "Journal" for Nov. 8, 1910, p. 392.]

There were 95 additional gas-lamps erected within the municipal borough and 55 in the out-townships during the year. The total number of lamps fixed in the whole of the supply area on March 25 was 6024. The total number of lamps of the incandescent type at that date was 4094 within the borough and 1607 in the out-townships; being an increase of 203 during the year. The high-pressure plant for lighting the lamps in front of the Town Hall has been replaced by another of a more modern and efficient type. The number of lamps supplied by the plant is six, each of 1500-candle power, and five of 500-candle power each—making a total of 11,500-candle power.

Appended to the report is an analysis of the expenditure per 1000 cubic feet of gas sold in the years ended March 25, 1909, 1910, and 1911.

HAMILTON CORPORATION GAS UNDERTAKING.

Annual Report.

The annual report by the Gas Engineer—Mr. J. Ballantyne—to the Corporation of Hamilton states that the quantity of gas made in the year ending May 15 was 161,779,700 cubic feet—a decrease of 1,352,500 feet. Gas sold through consumers' meters amounted to 136,686,750 cubic feet—a decrease of 1,090,650 cubic feet. For public lighting, 8,769,500 cubic feet was used—an increase of 993,800 cubic feet. The decrease in the consumption through consumers' meters occurred almost entirely during the early winter months, and was due to mild weather and an absence of fog. The total quantity of gas accounted for, including that used on the works, was 146,870,250 cubic feet, which left 14,909,450 cubic feet unaccounted for, equal to 9·22 per cent.—a decrease of 1 per cent. on the previous year. The gas unaccounted for, although very much less than it used to be, is regarded as being about double what it should be; but it is recognized that, so long as underground disturbances continue, it will probably be difficult to get it much below the present figure. The coal used was 15,486 tons—a decrease of 624 tons; and the yield of gas was 10,449 cubic feet per ton—an increase of 321 cubic feet. Since the introduction of coal-handling plant, the increase in the yield of gas per ton of coal has been 562 cubic feet, which, on the quantity of coal carbonized during the year, amounted to £780 at the present selling price of gas, and is fully £300 more than would have been necessary to pay interest and sinking fund charges on the total of £9023 which was expended on the new plant and the railway siding. Apart from the new plant, there has been no change in the systems of working, and, if anything, of late the quality of the coal had not been so good as formerly; so that the increased yield was entirely due to the introduction of the new plant. At May 15, the number of consumers through ordinary meters was 5003, and through prepayment meters, 2802—a total of 7805, as compared with 7661 last year, an increase of 144. The number of cookers on hire was 2292, as against 2117—an increase of 175. The total revenue was £22,119, and the expenditure £15,991, which included the cost of a new saturator. There was left to be carried to net revenue account £6128, which was £1833 more than last year. The amount carried to net revenue account, notwithstanding the reduction in the price of gas when the coal-handling plant was introduced—which was equal to £1515 on the year's consumption of gas—was the largest in the history of the gas-works.

At the meeting of the Town Council on Tuesday, the Gas Committee reported a net profit of £1942, which, with the balance brought forward of £1766, made a total of £3708. Before arriving at the balance, a

sum of £1000 had been applied as a third instalment towards liquidating the cost of the new plant. The Committee recommended that £2000 be transferred to the revenue of the common good, that £442 be placed to the contingency fund, and that the balance of £1266 be carried forward. The Engineer and Manager estimated for the current year a gross profit of £6786; and the Committee recommended the Council to reduce the price of gas by 2½d.—making the rates to ordinary consumers, 1s. 8d.; for street lighting and power purposes, 1s. 5½d.; and for prepayment meter consumers, 2s. and 2s. 4d. per 1000 cubic feet. The reductions, it was recommended, should take effect after the next survey; and instead of altering the prepayment meter indices, the recommendation was that the difference should be refunded to the gas consumers.

Bailie Anderson, the Convener of the Gas Committee, said the Council, he was sure, would be pleased to see such good results. These said much for the Gas Manager and his assistants. Ex-Provost Keith concurred in the congratulations which had been uttered; but he questioned whether, in the face of their results, they were justified in reducing the gas in the form proposed. He moved that they keep the price at the flat-rate of 1s. 8d.

The report was adopted by eight votes to seven.

TIPTON DISTRICT COUNCIL GAS DEPARTMENT.

The Annual Accounts.

The accounts of the Gas Department of the Tipton Urban District Council for the year ended the 31st of March last, as certified by the Auditor (Mr. James E. Rowley), have been issued. They are accompanied by a manufacturing statement for the past and the preceding years by the Engineer and Manager, Mr. Sidney O. Stephenson.

The accounts show that the gross sales of gas last year amounted to £14,575, compared with £14,267 for the year to March 31, 1910, or an increase of £308. After allowing for discounts and adjustments of stock, the net sales were £13,801, against £13,545, or an increase of £256. This increase is stated by Mr. Rowley, in his report on the accounts, to be entirely due to the increase in the receipts from the prepayment meters, the totals for which amount to £3991, against £3595 for the previous year, or an increase of nearly £400; and as these consumers are allowed a larger discount than the ordinary ones, a rise of some £30 in the discounts is due to this source. With regard to the residual products, all show a considerable increase—coke of £325, tar of £67, and ammoniacal liquor of £61. After allowing for discounts, there is a net increase of £445 on these items. The total sums to the credit of the revenue account amount to £19,539, against £18,789 for the year to March 31, 1910, or an increase of £750. On the debit side of the revenue account, the charge for coal amounts to £7259, against £7069 for the year to March 31, 1910, or an increase of £460, compared with the net increase of £256 in the sales of gas. This is wholly due to the larger quantity of coal used, and has been occasioned by the decrease in the make of gas per ton, as shown by the manufacturing statement of the Engineer and Manager. The cost per ton of coal carbonized was practically the same as in the preceding year—being 12s. 11½d. against 13s. 0¾d.

The net result of the year's trading is a gross profit of £5927, compared with £6067 in the year 1909-10, or a decrease of £140. From the gross profit, £2107 has to be deducted for interest on loans, and a further sum of £2401 for their repayment. These charges amount to £4508, which is £320 less than the corresponding charges for the year 1909-10. The net surplus to be carried to the accumulated profits account is £1419, or £181 more than for the year 1909-10. The amount standing to the credit of this account is now £6677. With regard to any disposition of the net profit of £1419, Mr. Rowley says it should be borne in mind that a sum of £945 was expended during the year on capital account, and that, in the absence of any loan, this expenditure had to be defrayed out of the profits; so that in that case there is a balance of some £450 only over the capital expenditure.

Mr. Stephenson's statement contains the following particulars:

	Year Ended March 31, 1911.	Year Ended March 31, 1910.
Coal carbonized	11,638 tons	10,831 tons
Gas made (total)	130,968,000 cub. ft.	126,368,000 cub. ft.
Make of gas per ton	11,253 ,,	11,667 ,,
Water gas added	2,406,000 ,,	1,273,000 ,,
Water gas, proportion of total make	1·83 per cent.	1 per cent.
Net coal gas made (deducting water gas)	128,562,000 cub. ft.	125,095,000 cub. ft.
Net coal gas made per ton	11,047 ,,	11,550 ,,
Gas sent from the works	131,262,000 ,,	126,445,000 ,,
Gas sold and used in works	114,121,875 ,,	110,083,475 ,,
Leakage, condensation, &c.	17,140,125 ,, (13¼ per cent.)	16,361,525 ,, (13 per cent.)

Sidmouth District Council and Gas and Electricity Supply.—Last Wednesday evening, a meeting of ratepayers was held in the Drill Hall, Sidmouth, with reference to the action of the Urban District Council in opposing the Sidmouth Gas and Electricity Bill. Mr. C. E. Roberts presided, and said the ratepayers had met by the invitation of the Council in order to have laid before them what had been done in the matter. The Council had opposed the Bill because they were of opinion that the Sidmouth Gas Company should not have a monopoly of the lighting of the town. By opposing, they had obtained a reduction of 10d. per 1000 cubic feet in the price of gas, and also had a clause inserted in the Bill which gave them the option of purchasing the Company's undertaking. Mr. Halse said the Council thought all present would agree with what had been done. He moved that the Council purchase the undertaking; and the motion was carried with nine dissentients. The Council will now take steps to promote a Bill to authorize the purchase.

GOOLE GAS AND WATER SUPPLY.

At the Meeting of the Goole Urban District Council last Wednesday, the accounts of the Gas and Water Departments were submitted and approved. In his report, the Engineer and Manager (Mr. J. Fazakerley) stated that the increased sale of gas compared with the year 1909-10 was 3,061,430 cubic feet, or 4 per cent. on the make. The increased yield of gas sold was 338 cubic feet per ton of coal carbonized. Coal cost 10d. per ton less than in the previous year; and residuals realized 1s. 8d. per ton more—being equivalent to 8s. 4d. per ton of coal carbonized. There was an increased revenue of £1315, and an increased expenditure of £501—the latter being on the general upkeep of the works and the renewing of old mains, &c. There was an increased transfer of £814; and the net profit was £1159. With regard to the Water Department, an increased revenue of £522 was reported, compared with the year 1909-10. The quantity of water pumped was 194 million gallons—an increase of 7,250,000 gallons. There was a decrease in wages of 1s. per million gallons, and a decrease of 1s. 6d. per million gallons in the cost of coal. The net profit was £782—an increase of £300.

THE LIGHTING OF BIDDULPH.

A meeting of ratepayers, convened by the Urban District Council for the purpose of discussing an electric lighting scheme, was held in the Public Hall, Biddulph, on Wednesday evening last—Councillor JOHN COPELAND presiding.

The CHAIRMAN said he thought the time had come when the streets should be lighted either with electricity or gas, and that Biddulph should have some light, both from a moral and a business standpoint. The question of purchasing the Gas Company's undertaking had frequently been discussed by the Council; but the price was considered excessive, and they must now consider the advisability of resorting to electricity as a means of lighting the parish.

Mr. ROBERT HEATH, J.P., remarked that his Manager (Mr. Allott) had helped to formulate a scheme as a means of getting over the difficulty and giving private consumers the opportunity of having electric light. It had been suggested to him that, as the firm were bringing electric power from Kidsgrove to Black Bull, perhaps they could convey it to Biddulph. He had gone carefully into the matter, and had got a scheme out, which he had submitted to the Council. On this plan, the Council could be supplied at 1½d. per unit; and without excessive charges, they could supply private consumers at 3½d. per unit. This was a reasonable price, as compared with other towns. One strong point in favour of the scheme was that if the Council obtained a number of consumers, they would not only make a profit, but the lighting of the town would cost nothing. They must, of course, be guaranteed sufficient private consumers. It would be no advantage to him; but it would be a good thing for the parish, for which he wanted to do all he could.

Councillor WHALLEY said 1d. per unit was equal to gas at 1s. per 1000 cubic feet.

Mr. J. R. L. ALLOTT, the General Manager to Messrs. R. Heath and Sons, then briefly outlined the scheme, which, he said, originated from Birchenwood, the source of supply. Some doubt had been cast on the continuity of supply; but there were two generating stations of 900 kilowatts, and if one broke down the other would be going on. Electricity had been brought to Black Bull for colliery purposes, and was used for pumping purposes night and day. The current was always on; and there was no fear of the supply discontinuing. The scheme combined safety and reliability; and compared with gas, electricity gave a better light, and was far more economical. The cost of gas in Biddulph was 4s. 3d. per 1000 cubic feet; electricity would cost 3½d. per unit, which was equivalent to 3s. 6d. for gas, a saving of 25 per cent. A splendid opportunity was given Biddulph to get cheaper light, which was very desirable. The price offered was such that the firm would make nothing out of it.

Councillor WALLEY asked how the Council were going to recoup themselves for the initial cost of £2270. He thought they should own and control their means of supply, and said now was the time to make an offer to purchase the Gas Company.

The CHAIRMAN replied that in 1908 the Gas Company were willing to supply gas at 3s. 10d. per 1000 cubic feet for street lighting, erect and maintain the lamps, and extinguish the lights. If 60 lamps were erected and burned four hours per day, it would cost £101. An additional expense of £60 or £70 per year would also be incurred until the loan was repaid. Lighting the streets would thus cost about £170 per year. On the other hand, if Messrs. Heath's offer were accepted and electricity purchased at 1½d. per unit, and sold at 3d. or 4d., the Council should make a profit to pay for lighting the streets. If the consumption grew, the profits would increase, and would go in aid of the rates.

Mr. HEATH said he was one of the foremost opponents of the purchase of the gas-works, which he always considered would be a most unbusinesslike proceeding. If the Council took that on, they would do so at a big loss. The gas-works had been in existence something like forty years; and during all this time, as a shareholder, he had never received any dividend. He was quite sure gas could not be produced to pay; and it was already at an excessive price. The principal reason was a business one. The works were old and defective; and it was monstrous to think of buying them. Even if they were bought, the site would have to be changed, as it was very unfavourably situated for the supply of coal, &c. It would be a foolish and impossible scheme. Gas at 3s. 10d. was going to cost £101 per annum; and electricity £32.

Councillor SHAW said there was no intention of having the scheme unless the Council could get a sufficient number of private consumers. A lot of shopowners would not pay the cost of the fittings.

Mr. HEATH remarked that it was certainly not worth while to light the streets alone.

Mr. HARDING thought it advisable to know the cost of lamps per year to working men in comparison with the cost of paraffin lamps.

Mr. ALLOTT stated that the cost would be 25 per cent. more, including the fitting of one light.

Mr. ENOCHS expressed the opinion that the initial cost would debar many from going in for the light. The upkeep, breakages, &c., would be too much.

Councillor WALLEY proposed that the Council make an offer to purchase the Gas Company at a reasonable figure. He said the present Council had never dealt with the matter.

The CHAIRMAN ruled this out of order; saying the meeting was called to discuss electric light, not gas.

Councillor COTTRELL proposed that the Council get more information as to the cost per unit, including fittings, &c.

Mr. OAKES said he should like to add to the motion that the Council also consider the lighting by gas.

Mr. ENOCHS moved, as an amendment, that the Council ascertain the probable cost per unit and the cost of two lamps fitted free into the houses.

On a show of hands, the amendment was declared carried; and it was announced that another meeting would be called when the Council had again discussed the question.

THORIUM SYNDICATE SUSPENDED.

The "Financial Times" last Friday published the following communication from a special correspondent on the subject of the suspension of the Thorium Syndicate.

For a considerable time past, negotiations have been proceeding among the principal European manufacturers of thorium, with the view of coming to an arrangement by which production and prices could be regulated; but these have at length been abandoned, as unanimity was found to be unattainable under existing circumstances. The supply of thorium was at one time a virtual monopoly, under the control of a powerful Continental Syndicate; but the "corner" has at length been broken, and the industry has fallen on evil days from the producer's point of view. Prices have steadily declined for two or three years, and are not unlikely to go considerably lower. This declining tendency is directly attributable to the glutting of the market with monazite sand—the principal raw material from which thorium is produced. The supplies of this sand were entirely controlled by the Thorium Syndicate. Inordinate greed proved the Syndicate's undoing, however; for the exorbitant prices charged forced the leading makers of incandescent mantles, including the Welsbach Incandescent Light Company and the German Incandescent Gas Company, to exert themselves to obtain independent supplies at all costs. In this they were successful; and prices fell rapidly. Practically the whole of the supply of monazite sands comes from Brazil; and thorium nitrate is manufactured only in the United States and on the Continent of Europe. The yearly consumption of monazite sand for the manufacture of thorium is placed at between 2000 and 2500 tons; but for some years the supplies have been equal to double the consumption. The contract between the Brazilian Government and the Thorium Syndicate has now expired; and a new lease of the fields is about to be arranged. There are numerous offerers; and as the Brazilian Government are not likely to allow any monopoly to acquire control of the supplies, a further flooding of the market, and consequent decline in prices, is feared.

"PAPER-BAG" COOKERY.

In view of the great publicity which has lately been given in the daily papers to the subject of paper-bag cookery, the supplier of gas is not likely to lose the opportunity of bringing to the notice of the public the peculiar adaptability of gas-cookers for this method of preparing viands for the table. To reap the full benefit of the curiosity which has been aroused, however, oral lectures and practical demonstrations are necessary, when the advantages of the new over the old method of cookery, and (incidentally) of gas over any other fuel, can be shown in a convincing manner. Bearing this in mind, Messrs. R. & A. Main, Limited, inaugurated a series of lectures at their show-rooms at No. 83, Old Market Street, Bristol, on the 3rd inst.; and the success achieved was instantaneous. This is evinced by the fact that more than 500 applications for tickets were made in less than two days; and that instead of holding one demonstration each night, as was originally intended, Messrs. Main had to adopt the modern music-hall method of "two houses nightly," and lengthen indefinitely the one week which was at first to have been the duration of the demonstrations.

The subject is referred to as follows by Miss Helen Edden in the current number of the Gaslight and Coke Company's "Co-Partners' Magazine:" "This method of cooking has been in use for many years, as reference to any good book will show. French cooking *en papillotes* it is called; the only difference now being that the process is simplified by using paper bags, instead of oiled or buttered paper, to form a case. This method of cooking is essentially good for fish, such as cod cutlets, salmon steaks, and small filleted fish, as the whole of the flavour is retained, and there is no smell arising during the process of cooking—which odour so often prevails, and is very penetrating. I should advise always oiling or buttering the bags. Dried fish, such as bloaters, kippers, and haddocks, can be successfully cooked; but the economical user of gas must bear in mind that by this paper-bag process the oven gas must be alight for 10 to 15 minutes, then lowered to half, and the fish will take another 10 to 12 minutes, making 25 minutes for the fish, instead of 7 minutes with the griller. It is better to remove the browning-shelf while heating-up the oven, and to slip it in when the paper bags are put in the oven. The two grid shelves should be spaced at the top of the oven, and the solid shelf below, about a foot from the flames, to prevent smothering. Lower the gas one-half or rather less when cooking. . . . Paper-bag cookery should be used only for small things, such as kidneys, tomatoes, cutlets, pigeons, small savoury dishes, and fish."

REDUCTION IN PRICE AT READING.

In view of the provisions of the Bill for Extending the County Borough of Reading, the Directors of the Reading Gas Company have given notice that the price of gas to ordinary consumers within the limits of the borough as extended will be at the rate of 2s. 5d. per 1000 cubic feet as and from the 1st inst., and that the annual charge for the public lamps in Tilehurst and Caversham will be based upon the schedule of prices in force under the terms of the present contract with the Reading Corporation. The prices for the standard patterns of lamps (extinguished at eleven o'clock) in the two districts will be: Tilehurst, £1 12s. 5d. per annum; Caversham, £1 12s. 2d. per annum. The prices for the small number of other types of lamps in use will also be reduced in accordance with the schedule referred to. Immediate steps will be taken to give prepayment consumers in the added districts the full benefit of the revision. The prices in the areas outside the extended borough will, for the present, remain as before.

The public lighting of Caversham—one of the districts affected by the change in the price—having recently been the subject of some comments in the "JOURNAL" in connection with the electric lighting contract entered into by the Urban District Council, it may be mentioned that the price of gas there previous to the 31st of March last was 2s. 10d. per 1000 cubic feet; and the Reading Company's charge for the public lamps fitted with No. 3 Kern burners, extinguished at eleven o'clock, was £2 1s. 4d. per annum. Under the altered conditions, it is only £1 12s. 2d. The Reading Electric Supply Company are substituting for the No. 3 Kern burners lamps fitted with two 55-watt burners alight until eleven o'clock; and for these they are charging £1 17s. 3d. per lamp per annum. The Gas Company's reduced charge therefore compares very favourably with that of the Electric Light Company, and deprives the Chairman of the District Council of one of the principal arguments of which he made use when accepting the Electric Light Company's contract—viz., that they would effect a saving of £88 per annum. Instead of doing this, they will incur considerable loss.

FYLDE WATER BOARD'S JUBILEE.

In Search of a New Supply Area.

In celebration of the jubilee of the Fylde water undertaking, members of the four constituent authorities, at the invitation of the Board, made an inspection last Thursday of the water-works at the base of the hills east of Garstang, and saw for themselves the steps being taken to cope with the increasing demand by consumers in Blackpool, Fleetwood, Lytham, and St. Annes districts. The party, which numbered 67 in all, included Alderman J. Bickerstaffe, J.P., of Blackpool (the Chairman of the Board), Mr. C. Arthur (the Secretary), Mr. J. Cook (the Engineer), and Mr. A. V. Riley (the Manager).

Much attention was paid to the new Grizedale Lea reservoir works, on which about 250 men are now engaged—a number that will shortly be increased to some 400. This reservoir will be 34 acres in extent, and 50 feet deep, with a holding capacity of 330,000,000 gallons. The geological faults encountered, and how they were dealt with, were explained by Mr. Cook, who acted as guide. It was stated, in the course of the general inspection, that the North Barnacre reservoir is 28 acres in extent, and has a holding capacity of 96,000,000 gallons; while the South Barnacre reservoir is 16 acres in extent, and holds 60,000,000 gallons. The Grizedale reservoir covers 13 acres, and has a holding capacity of 80,000,000 gallons. It was also explained that one of the improvements the Board propose to carry out as soon as matters are settled by arbitration with Mr. Garnett, the owner of land on which are numerous springs, is to catch the water of these springs in pipes, and carry it direct to the Calder conduit. The advantage of this was obvious, said Mr. Cook. Instead of running into the blackened River Calder, when there is a storm, the pure spring water will be conveyed direct to the reservoirs; and this water will therefore be saved from running to waste, as frequently happens now. It is also proposed to construct a channel through the silt bed, and thus prevent much of the discoloration, which no practicable filtration will remedy.

Following a dinner served at the Kenlis Arms, Garstang, at the close of the inspection, a short toast list was gone through. Replying to the toast of "Success to the Fylde water undertaking," Alderman Bickerstaffe referred to the difficulties they had had to contend with in the construction of the new reservoir. There was not a water undertaking in the kingdom, he said, that had not some such troubles, and probably greater ones than had faced the Fylde Water Board. Some delay and additional expense had been caused in consequence; but it was not anything more than all other such concerns had had to contend with. As to the future, this was a serious matter. When he told them that their consumption had doubled within the last ten years, they might judge that it was quite necessary to be looking further ahead. They had three sites in view for a new water area, but had not finally selected one.

London County Council and Improved Gas Lighting.—The London County Council have accepted an offer from the Gaslight and Coke Company, at £85 2s. 4d., for improving the lighting of the north pontoon of the Woolwich Ferry, by substituting better lanterns fitted with inverted burners. It is stated that by carrying out this improvement an average annual saving of about £70 will be made, while at the same time a greater amount of light will be obtained. The Council are in negotiation with the South Metropolitan Gas Company with a view to effecting similar economy in the lighting of the south pontoon. As a result of negotiations with the Wandsworth and Putney Gas Company, an offer by them has been accepted for the conversion of the lamps on Putney Bridge to the inverted type, at the cost of the Company. The result of this will be that the illuminating power will be increased from 2000 to 8500 candles, while the annual cost of gas is estimated to be increased from £95 to £98 12s. only.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the annual report which was submitted to the Perth Town Council on Tuesday, it was stated that the past year has been one of the most prosperous in the history of the gas department. There is a balance at the credit of the revenue account of £13,692; and there is a net balance of £426 to carry forward. Gas sold during the year amounted to 224,092,000 cubic feet—an increase of over 3½ million cubic feet. It is proposed to reduce the price of gas by 1d. per 1000 cubic feet—making it 2s. 9d. to ordinary consumers, and 3s. to prepayment meter consumers—and to reduce the charge for public lighting from 2s. 6d. to 2s. 4d. per 1000 cubic feet. The scheme of charges for gas for commercial, industrial, and power purposes—ranging, according to consumption, from 1s. 4½d. to 2s. 6d.—it is proposed to leave undisturbed.

The Corporation of Glasgow and the Busby and District Gas Company have been in conflict for some years over the supply of gas to the districts contiguous to the area served by both parties. I daresay the quantity of gas which might be sold in the district is not of so much moment to the Corporation as is the preventing of any body of gas suppliers from obtaining statutory powers over the area, which would have to be paid for at a heavy rate in the event of the area being brought into the city. The subject was considered worth fighting for at Westminster, where it was before a Select Committee of the House of Lords on two separate days this week. Both parties sought rights in the area which they do not at present possess; and the decision of the Committee, given on Thursday, was that the Busby Company get what they sought, less the portion which the Corporation were desirous of having, subject to the condition that in 1912 the Corporation shall obtain power to include this area within the limits of their gas supply. That is to say, the Corporation have won the point they made—that the Company should not obtain statutory power over a district which the Corporation have a desire to serve.

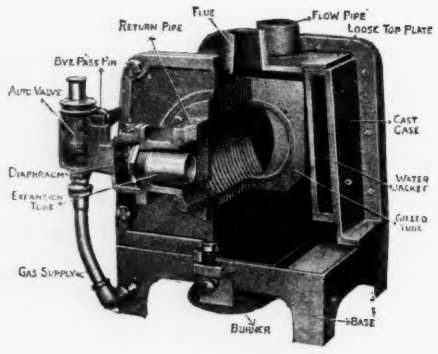
The annual meeting of shareholders of the Stirling Gas Company was held in the Company's office on Tuesday, under the chairmanship of ex-Provost Kinross. The report of the Directors stated that the net revenue from the sale of gas during the year was £15,997; from meter-rents, £721; from rents of stoves, £281; and from the sale of residual products, £5142. The balance at the credit of the ordinary account, after providing for ordinary maintenance and repairs and renewals, amounted to £4846, to which fell to be added the sum of £3735 brought forward from the previous year. After payment of all charges, there remained a balance of profit on the year's working amounting to £7474. The Directors recommended payment of dividends, on the original capital, at the rate of 9s. 5½d. upon each share of £5 7s. 6d., and on the new ordinary shares at the rate of 11s. upon each £10 share—amounting together to £4537; that £412 be added to the reserve fund, raising it to £734; and that a balance of £2790 be carried forward. The dividends were at the same rate as last year. The report also mentioned that since their last annual meeting Mr. David Chrystal, one of the Directors of the Company, had been removed by death. The Directors regretted to find that no securities existed for the sum of £500 belonging to the reserve fund, which, since the last annual meeting, had been entrusted to Mr. Chrystal, as Law Agent of the Company, for investment in heritable securities which had been submitted to, and approved of by, the Directors. As advised, the Directors proposed to write off this loss; but a claim had been made against Mr. Chrystal's estate, and any sums received would be credited to the reserve fund. There had been an increased consumption of gas during the year. The report was adopted. The Manager—Mr. J. M. Smith—reported that the works were being maintained in a satisfactory condition.

The Directors of the Selkirk Gaslight Company reported to the shareholders at their annual meeting on Tuesday that the past year's working showed a very satisfactory result. The quantity of gas made was 40,780,200 cubic feet—an increase of 284,700 cubic feet over the preceding year. Gas sold amounted to 38,088,200 cubic feet. Coal carbonized amounted to 4113 tons; and the yield of gas was 9915 cubic feet per ton. It was recommended that the price of gas remain at the same figure; and that the profit for the year—£1431—be applied in payment of a dividend at the rate of 4 per cent., and in placing £250 to depreciation account and £455 to surplus account. These recommendations were adopted.

The gas made in the Dunfermline Corporation gas-works during the past year amounted to 140,113,000 cubic feet—an increase of 5,290,000 cubic feet over the previous year. The gas sold amounted to 132,040,600 cubic feet—an increase of 6,081,600 cubic feet. At the monthly meeting of the Town Council on Monday, Mr. T. Stewart, the Convener of the Gas Committee, stated that the matter of supplying gas to Culross had taken a turn which necessitated the Committee holding their hands, so far as they could do so, in the meantime. The Committee had entered into a contract for the laying of pipes between Dunfermline and Culross, and the Fife Coal Company, Limited, had intimated their intention to establish at Newmills works for the supply of gas to their own workpeople there. He was hopeful that the Committee would be able to come to an amicable and satisfactory arrangement with the Company. The agreement with Culross had not yet been signed.

The Cardenden Gas Company, Limited, earned net profit last year to the amount of £572. A dividend of 5 per cent. has been declared; and it has been resolved to give prepayment meter consumers a rebate of 2½d. per 1000 cubic feet of gas consumed.

In the Kirkcaldy Town Council on Monday, the Finance Committee recommended that Mr. Maxwell, the Burgh Chamberlain, be granted an increase of his salary, raising it from £350 to £400, and that the question of an honorarium for work done in connection with the taking over of the gas undertaking be considered at a later date, when the whole work is finished. The proposed increase was agreed to by 16 votes to 8.



The actual section of which this is a photograph may be seen at our London Show-Rooms.

IF you have not yet verified all we have said in these pages regarding the unique claims of the GILLED CIRCULATOR, it is easy to do so. Pay a visit to our London Show-Rooms, where the Circulator may be inspected in operation. We desire merely to remind you *now* that every claim put forward for the "Gilled" is a proof of its triumph in the matter of

MAINTENANCE.

London Show-Rooms: 59, Queen Victoria St., E.C.

(Phone; 742 Bank.)

The DAVIS Gas Stove Co Ltd. Luton

On Monday, the Town Council of Burntisland met as Gas Commissioners to consider their annual work. The report of the Gas Manager—Mr. Alex. Ross—was to the effect that there had been an increase in the quantity of gas made, which last year amounted to nearly 24 million cubic feet. In 1897, the output was only 10½ million cubic feet. The increase was attributed to the large expansion which there has been in the demand for gas for cooking and heating as well as for lighting. The estimate for the current year is that there will be a further increase in the demand for gas of from 1½ to 2 million cubic feet. In anticipation of this, the Council agreed to reduce the price of gas to consumers within the burgh to 2s. 11d. per 1000 cubic feet, after the August reading of the meters; the usual discounts and abatements for gas used for power being continued.

The Coupar Angus Gaslight Company have paid a dividend of 6 per cent., and reduced the price of gas from 5s. 7½d. to 5s. 5d. per 1000 cubic feet.

The Kelty Gas Company, Limited, have just paid a dividend of 6 per cent.

The Cupar Gas Company, Limited, have paid a dividend at the rate of 5 per cent. on the preference stock of the Company, and of 40s. per share upon the ordinary stock.

In the Broughty Ferry Town Council on Monday, Mr. C. T. Godfrey, the Convener of the Gas Committee, said they had had a phenomenally good year, for which he complimented the Manager. The result, financially, had been a decrease of £95 in revenue; but they reduced the price of gas last year by 1d. per 1000 cubic feet. A feature of the accounts was the yield from residual products, which showed an increase of £320. From all sources, their revenue showed an increase of £111. The Committee proposed to take 1d. off the price of gas; making the charge 2s. 8d. per 1000 cubic feet. The estimate was for a credit balance of £100 at the end of the year. The accounts and estimates were agreed to.

In the Brechin Town Council on Monday, Treasurer Archibald reported that the Committee which was appointed to inquire into the question of the purchase of the gas undertaking had been making inquiries, and had acquired considerable information.

It is reported that the I ighting Committee in Tulliallan have agreed to the terms offered by the Kincardine-on-Forth Gaslight Company, Limited, for a supply of gas. The agreement is to last for ten lighting seasons. The price of gas is to be 4s. 2d. per 1000 cubic feet, which, it is stated, is 2d. per 1000 cubic feet more than the former rate.

The Vale of Leven Gas Company (Alexandria) had a profit last year of £3106, out of which a dividend at the rate of 5 per cent. has been paid, and £1000 has been placed to reserve and depreciation fund.

Reduction in Price.—The Ackworth, Featherstone, Purston, and Sharlston Gas Company have, as from the 1st inst., reduced the price of gas 2d. per 1000 cubic feet for public lighting and 1d. for ordinary purposes.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 195.]

LIVERPOOL, *July* 15.

Sulphate of Ammonia.

Although the demand has hardly been so vigorous as that recently experienced, the requirements during the past week have been sufficient to absorb current production, and the prices realized have again been in favour of sellers. At the close, the nearest values are £13 11s. 3d. to £13 12s. 6d. per ton f.o.b. Hull, £13 12s. 6d. to £13 13s. 9d. per ton f.o.b. Liverpool, and £13 13s. 9d. to £13 15s. per ton f.o.b. Leith. The volume of business that has transpired in the forward position has not been large; but it is reported that £13 17s. 6d. per ton f.o.b. Leith has been obtained for January-April shipment next year, while manufacturers are now holding for this figure for delivery October-December this year or the first half of 1912.

Nitrate of Soda.

The market for this article has become rather firmer, and holders have advanced their quotations to 10s. per cwt. for 95 per cent. and 10s. 3d. for 96 per cent. quality, on spot.

LONDON, *July* 17.

Tar Products.

The markets for tar products remain very steady. The value of pitch has improved during the week, and there has been a decided advance in the price. Benzols continue steady, although there is no material alteration in the value. In solvent naphtha, there has been a little inquiry; but contracts are reported to have been taken at low figures. Creosote maintains its price; and the outlook seems good. In crude carbolic, improved prices are stated to have been offered for forward business, no doubt on account of the number of inquiries for crystals.

The average values during the week were: Tar, 19s. 3d. to 22s. 3d., *ex* works. Pitch, London, 38s. 6d. to 39s.; east coast, 38s. to 38s. 6d.; west coast, Manchester, 37s. 6d. to 38s., Liverpool, 38s. to 38s. 6d., Clyde, 38s. to 38s. 3d. Benzol, 90 per cent., casks included, London, 9d. to 9¼d.; North, 9d.; 50-90 per cent., casks included, London, 8¾d. to 9¼d.; North, 8¼d. to 9d. Toluol, casks included, London, 9¾d. to 10d.; North, 9¼d. to 9½d. Crude naphtha, in bulk, London, 4d. to 4¼d.; North, 3¾d. to 3½d.; solvent naphtha, casks included, London, 11d. to 11⅜d.; North, 10d. to 10½d.; heavy naphtha, casks included, London, 11½d. to 1s. 0¼d.; North, 10d. to 10½d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2d. Heavy oils, in bulk, 2¾d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 10½d. to 1s. 11d.; west coast, 1s. 9½d. to 1s. 10d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., bags included. Anthracene, "A" quality, 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

This market is very firm, and there has been a further rise in the value. Actual Beckton is quoted at £13 5s.; outside London makes,

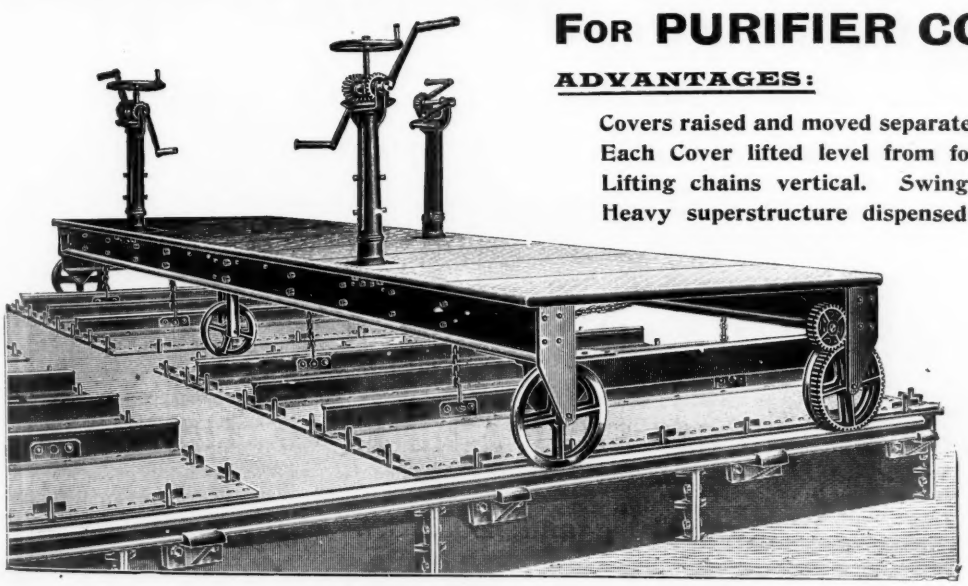
R. & J. DEMPSTER, Ltd.,

Telegraphic Address:
"SCRUBBER MANCHESTER."

MANCHESTER.

HOVEY'S PATENT LIFTING CRANE

FOR PURIFIER COVERS.



ADVANTAGES:

Covers raised and moved separately or Two together.
Each Cover lifted level from four points.
Lifting chains vertical. Swinging avoided.
Heavy superstructure dispensed with.

Prices and Particulars on Application.

London Office: 165, GRESHAM HOUSE, OLD BROAD ST., E.C.

£12 17s. 6d.; Hull, £13 10s.; Liverpool, £13 12s. 6d.; Leith, £13 15s.; and Middlesbrough £13 10s. For the forward position, a premium of 2s. 6d. to 5s. per ton is asked.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a fuller demand for coal; and the possibility of some stoppage in a part of the northern coalfield is causing users to stock supplies. In the steam coal trade, the inquiry is good, and prices are steady. Best Northumbrians are from 11s. 3d. per ton f.o.b., second-class steams are 9s. 3d. to 9s. 6d., and steam smalls are 5s. to 6s. The production at the pits is full; and the output is well taken up. In the gas coal trade, the demand is now beginning to increase, though only slowly at first, for home needs; but the exports are very full. Durham gas coals are about 9s. 3d. per ton f.o.b. for second-class coals; best Durhams are 10s. 3d.; and "Wear" specials from 10s. 9d. to 11s.—the latter class being in brisk inquiry. Some sales of cargoes for Genoa are reported, at prices that are thought to be a little below those now current; but they include the freight on the coal, which fluctuates a good deal. One or two other contracts are in close treaty; but coalowners do not like at present to bargain too far forward till they can better estimate the cost of some legislative changes. Coke is steady. Gas coke, being now in slow output, is rather firmer, and good makes are from 14s. to 14s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

There has been a little more activity in coal circles, which, however, may not mean much more than that the cessation of trouble with seamen and dockers has brought a material improvement in the export department. Also, in the west, the miners' holidays are on; and there is always a slight spurt immediately before them, due to the laying in of stocks to tide over the time when the pits are idle. The prices now quoted are: Ell, 8s. 9d. to 9s. 9d. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 322,025 tons—a decrease of 1196 tons upon the previous week, but an increase of 2175 tons upon the corresponding week last year. For the year to date, the total shipments have been 8,253,411 tons—a decrease upon the corresponding period of 22,891 tons.

Bursting of a Water-Main in Edgware Road.—A water-main in Edgware Road, W., burst last Friday afternoon, and in a few minutes the roadway was flooded for about 200 yards. The flood subsided in about an hour, leaving the roadway like a petrified sea; the water having forced the surface up in a succession of "waves," some of them 2 feet high. Little damage was done in the flooded basements, most of which were coal-cellars.

Hoylake and West Kirby Gas and Water Company.

The report of the Directors and the accounts for the year ending June 30 (which will be submitted at the thirty-fourth ordinary general meeting of the Company) show that the balance at the credit of profit and loss, after payment of the dividends in respect of the year to June, 1910, is £2056, to which has to be added the net revenue for the past twelve months, £7952—making a total of £10,008. Deducting the interim dividend paid in January (£2600), there is available a sum of £7408. From this, the Board recommend the payment of the following dividends: 6 per cent. on the "A" gas original capital; 4½ per cent. on the "B" gas additional capital; 6 per cent. on the "A" water original capital; and 4½ per cent. on the "B" water additional capital. These will absorb £3899, and leave a balance of £3509. After transferring £111 to the water back-dividend reserve, £342 to the gas, and £150 to the water contingency and plant renewal fund, and adding £433 to the gas reserve fund, there is left a sum of £2473 to carry forward. The dividend scheme, together with the interim dividend paid in January, represents a total distribution, less income-tax, for the year of 10 and 7 per cent. on the "A" and "B" capitals respectively. The gas reserve fund will then stand at £2164. The quantity of gas supplied last year to private consumers and the public lamps was 59,066,022 cubic feet. The price of gas during the period under review was 3s. 6d. per 1000 cubic feet, less varying discounts; while the charge to users of prepayment meters was 4s. 2d.

Seville Water-Works Company.—After providing for administration expenses and debenture interest, the accounts for the year ended March 31 show a net profit, including £8556 brought forward, of £17,383. The Directors recommend a dividend of 3 per cent., and the transfer of £5000 to the reserve (making it £15,000); leaving £4249 to be carried forward.

Indian Water-Works.—The proposals of the Municipality of Cawnpore for the extension of the city water-works have been approved by the Government of the United Provinces. The scheme includes a large multiple filtration plant for dealing with the water of the Ganges. The filters will have a capacity of 7 million gallons per 24 hours. The Consulting Engineers are Mr. H. Chabal, C.E., of Paris, and Mr. Walter Clemence, of London.

Kenilworth Gas Company.—At the 58th annual meeting of the Kenilworth Gas Company, the Chairman (Mr. Thomas Kemp, J.P.) stated that they had raised further capital during the past year, and had reduced the price of gas to the ordinary consumers; but they were still able to pay a dividend of 7½ per cent. on the ordinary shares. The accounts showed receipts (including a balance of £1029 brought forward) amounting to £5255, as compared with £5102 for the previous year; while the expenditure on revenue account totalled £3372. Mr. Thomas Berridge, J.P., of Leamington, the Engineer to the Company, was elected to the Board as Managing-Director.

86 Degrees in the Shade

130 in the Sun.

These are startling figures even for July, but not so startling as the radiant heat figures we shall be able to give you from our "A.B.C." Gasfires this coming season.

"WAIT AND SEE."

The RICHMOND GAS STOVE & METER CO., Ltd.,

Gasfire Specialists,

WARRINGTON and LONDON.

Sales of Stocks and Shares.

There was an extremely good demand for the new capital issues and other stocks and shares which Messrs. A. & W. Richards offered for sale at the Mart, Tokenhouse Yard, E.C., last Tuesday. Under instructions from Directors, additional capital in the Gravesend and Milton Water Company, the Sutton Gas Company, and the Southend Water Company was placed. The new issue of the first-named Company consisted of £10,000 nominal capital in 4½ per cent. preference shares of £20 each; and they were all sold at £22 10s. apiece. The Sutton Gas Company had for disposal £6500 of 4½ per cent. mortgage debentures; and they were purchased at from par to £100 10s. per £100. The new issue of the Southend Water Company comprised £5000 of 4 per cent. perpetual debenture stock and 500 new £10 ordinary 5 per cent. maximum shares. The stock was placed at from par to £101 per £100; and the shares, which will carry 4½ per cent. dividend, were sold at par. By order of executors and another owner, some £10 fully-paid "A" shares and some "A" stock of the East Grinstead Gas and Water Company were offered for sale. Both rank for a maximum dividend of 10 per cent.; and they received dividends at the rate of 9½ per cent. for the year ended Dec. 31 last. The shares fetched from £18 to £19 5s. each; and the stock was sold at £182 per £100. Some £10 "B" and "C" shares (7 per cent., but last dividend £6 13s. per cent.) in the same Company fetched £12 10s. in the former case, and £12 10s. to £12 12s. 6d. in the latter. By order of executors, a few fully-paid £5 ordinary shares in the Redhill Gas Company, carrying 10 per cent. dividend as from Jan. 1 last, fetched £10 2s. 6d. each; and £100 of ordinary "B" stock (carrying 5 per cent.) was purchased for £102 10s. At the Castle Hotel, Windsor, next day, Messrs. Buckland and Sons offered a number of shares in the Windsor Gas Company. Eight original shares of £20 fetched £44 5s. apiece; seventeen preference shares of £8 realized £10 10s. each; three new £20 shares, £32 5s. each; and eleven similar shares, on which £8 had been paid, were sold for £11 15s. each. At a recent sale at Ramsgate, £3500 of new ordinary "D" stock of the Broadstairs Gas Company was offered in £20 lots, which fetched, on an average, £26 15s. each. Some 4 per cent. perpetual debenture stock of the Company was sold at par.

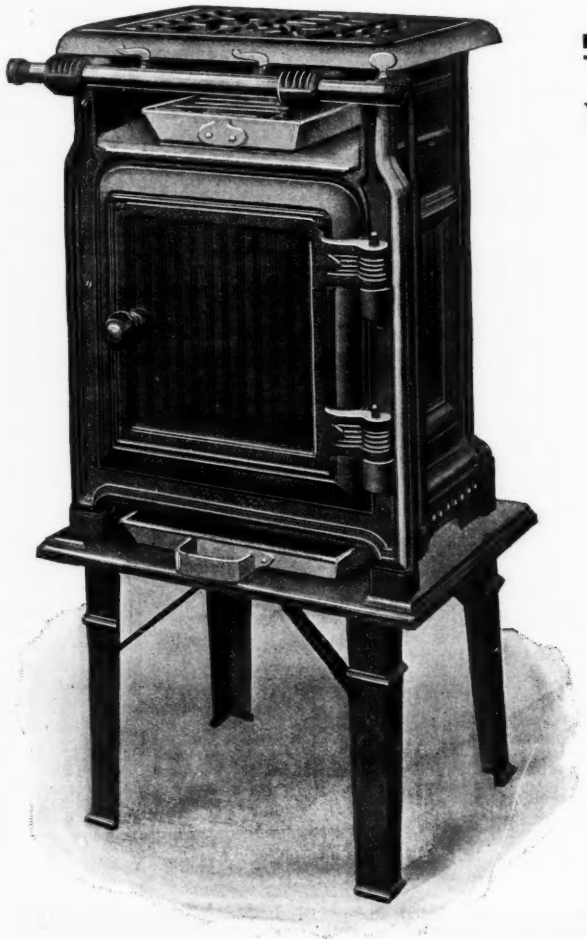
Inspection of London Water-Works by Japanese Delegates.—An important party of the delegates from Japan were received by the Chairman of the Metropolitan Water Board (Mr. E. B. Barnard) and the Clerk (Mr. A. B. Pilling) at the offices of the Board last Tuesday morning, and were subsequently conducted by the Chairman and Engineer on a visit of inspection to some of the works of the Board—including the large pumping-stations and filter-beds at Lea Bridge, the storage reservoirs at Walthamstow, the new reservoir at Chingford (approaching completion), the Hampton and Kempton Park works, the reservoirs at Walton, and the engine-house there recently opened by the President of the Local Government Board.

Boston Gas Company.—The net profits of the Boston Gas Company for the past year were £5866, which enabled the Directors at the annual meeting to recommend the payment of full parliamentary dividends, and to reduce the price of gas 3d. per 1000 cubic feet.

New Joint-Stock Companies.—The Counties Gas Company, Limited, has been registered, with a capital of £40,000 in £10 shares, to take over the works of the Mid-Oxfordshire Gaslight and Coke Company, Limited, and the business of the Bucks and Oxon District Gas and Coke Company, Limited, and to adopt an agreement made with Mr. W. A. Schultz. The first Directors include Messrs. W. C. Parkinson and W. A. Schultz. The Company is a private one; and the registered office is at No. 50, Cannon Street, E.C.—The Switch-On Gas Lighting Syndicate, Limited, has been registered with a capital of £1100, in 1000 ordinary £1 shares, and 2000 deferred shares of 1s. each.—The Aberlady and Gullane Gas Company was registered in Edinburgh last week, with a capital of £6000, in shares of £5 each.

Allowance of Electricity to London County Council Caretakers.—About eighteen months ago, the London County Council decided that as from Jan. 1, 1910, and until further order, caretakers of secondary schools and training colleges living in quarters provided by the Council should be allowed 40,000 cubic feet of gas annually, and that they should be required to pay for any gas consumed in excess of this quantity. The Education Committee of the Council consider it is desirable that a similar limit should be fixed in cases in which the quarters are lighted by electricity. The average price of gas is 2s. 6d. per 1000 cubic feet, and of electricity 3½d. per unit. An annual allowance of 350 units, which the Committee regard as approximately equivalent to 40,000 cubic feet of gas, would, they think, be reasonable. Where gas is used as well as electricity, the combined cost should not exceed £5 annually. They brought up a recommendation to this effect at the meeting of the Council last Tuesday; and it was adopted.

Gisborne (N.Z.) Gas Company, Limited.—In the report presented by the Directors of this Company at the last annual meeting, it was stated that the sale of gas in the twelve months ended the 31st of March showed an increase of nearly 2½ million cubic feet, or about 8½ per cent., compared with the preceding year; and that the price had been reduced equal to 6 per cent. The revenue from the sale of gas, residuals, &c., was £12,769; and the total receipts were £16,071. The balance on the profit and loss account was £5820. On Sept. 30 last, an interim dividend amounting to £1842 was paid; and the Directors recommended the payment of a further dividend of 1s. 6d. per share on all shares issued to the date named, and of 9d. per share on those dating from Jan. 1, 1911, amounting to £1845, the placing of £2000 to the general reserve, and the carrying forward of £1975. The Chairman (Mr. J. T. Evans), in moving the adoption of the report, said the Company were in possession of works of which the shareholders might be justly proud; and their management did not need comment, as it spoke for itself. The report was adopted; and a vote of thanks was accorded to the Engineer and Manager (Mr. Henry Hoare) and the staff for their services during the year.



WITHIN THE RADIUS

of most Gas Undertakings there is usually a large number of flats and small dwellings.

The ordinary Gas Cooker may be too large for these, and the circumstances demand the use of small Cookers such as "MAIN'S"

KENT

or

SUSSEX

which are just large enough to meet ordinary purposes and just small enough to fit into a corner or recess.

These Cookers embody all the features which make the "MAIN" Lines pre-eminent for efficiency and economy.

R. & A. MAIN, LTD.,

WORKS:

Gothic Works, EDMONTON, N.; and Gothic Iron-Works, FALKIRK.

SHOW-ROOMS:

25, Princes St., Oxford Circus, W.; 136, Renfield St., GLASGOW; 56, Broad St., BIRMINGHAM; 83, Old Market St., BRISTOL; 13, Whitworth St. West, MANCHESTER; 333, Queen St., MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY.

Bankruptcy of a Gas-Stove Manufacturer.—The public examination took place at Warwick last Friday, before Mr. Registrar Campbell, of Mr. Charles Edwin Ryder Terry, of Leamington. The main facts of the case were recorded in the "JOURNAL" for the 4th inst. (p. 50). The debtor—who does not admit his insolvency—was questioned at length; and the matter was adjourned until the 2nd prox.

The Recent Explosion at Stalybridge.—At a meeting of the Stalybridge Gas Committee, it was resolved that the offer of the Insurance Company to pay the sum of £557 in settlement of the claim for damage caused by the recent explosion at the gas-works be accepted. It was also resolved that the tender of Messrs. W. C. Holmes and Co., of Huddersfield, for a new Livesey washer and a new rotary naphthalene washer be accepted.

Mr. Justice Warrington, sitting in the King's Bench Division of the High Court of Justice, had before him last Wednesday the case of *Morgan v. Water-Works, Lighting, &c., Corporation, Limited*, and others. When the case was called, Mr. Montagu Shearman, K.C., who appeared for the plaintiff, said terms (which were not stated) had been arranged; but he asked his Lordship to let the matter stand over with regard to some of the defendants, who would be communicated with. His Lordship agreed.

We have received from Messrs. C. & W. Walker, Limited, of Donnington, their latest illustrated booklet on Milbourne's patent luteless purifiers and purifier valves, of which they are sole makers. The various types are preceded by an enumeration of the advantages claimed for these appliances, and a list of the gas-works in which they have been erected. Particulars are also furnished of Milbourne's cover fasteners, and rubber jointing, as well as of lifting apparatus. The illustrations are very effective; and the booklet altogether is an artistic production.

By the generosity of the Directors of the Littleborough Gas Company, the employees had their first excursion last Wednesday to Northwich, where they were met by Mr. S. S. Mellor, the Engineer and Manager of the Northwich Gas Company, and members of his staff, who accompanied the party throughout the day. They received a hearty welcome at Vale Royal Abbey, from Mr. and Mrs. Robert Dempster, by whom they were personally conducted over the house and through the extensive and beautiful grounds and gardens, conservatories, &c. The visit was one of much interest; and Mr. S. E. Halliwell, the Manager and Secretary of the Littleborough Gas Company, and Mr. G. P. Smith, the Cashier, expressed the sincere appreciation of the party of the generous hospitality and the kindly welcome extended to them. Later in the day, thanks were expressed to the Directors of the Company for granting facilities for arranging the excursion. Mr. Halliwell assured the men that the Directors hoped the innovation would further strengthen the good feeling and pleasant relationship existing among the employees.

At the meeting of the Council of the Royal Society of Arts on Monday last week, Lord Sanderson, G.C.B., who has been a member of the Society for upwards of thirty years, was elected Chairman.

It will doubtless interest our readers to learn, in connection with the investiture of the Prince of Wales at Carnarvon last Thursday, that the whole of the special cooking apparatus used in the preparation of the banquet was manufactured and supplied by the firm of Messrs. Fletcher, Russell, and Co., Limited, of Warrington. We may add that complete satisfaction was given by the cooking apparatus to both the caterers and the large number of guests on this historic occasion.

The many friends of Mr. W. B. Randall (Secretary, Engineer, and Manager of the Waltham Abbey and Cheshunt Gas and Coke Company) will be sorry to hear that he has sustained a sad loss by the death, on the 6th inst., of his wife, who had been in failing health for a considerable period. The interment took place in Cheshunt Cemetery on Monday of last week, amid tokens of the deepest sympathy and respect; those attending the funeral including numerous employees of the Gas Company.

APPLICATIONS FOR LETTERS PATENT.

15,388.—UNRUH, M. VON, and WEIGEL, A., "Mantles." July 1.
15,393.—RESTLER, J. D. K., "Gas-producers." July 1.
15,396.—WILSON, C. E., "Fuel for gas-fires." July 3.
15,425.—OWEN, J., "Clearing jets of burners." July 3.
15,451.—LENTSCHAT, G., "Incandescent burners." July 3.
15,463.—KITSON, A., "Lighting and heating apparatus." July 3.
15,497.—HODKINSON, C., "Gas smoke shield." July 4.
15,520.—BURDON, J., W. M., & M. M., "Production of oil-gas." July 4.
15,532.—SCHULTZE, G. A., "Device for measuring the quantity and the current velocity of fluids and gases flowing through pipes." July 4.
15,553.—GAMMENTHALER, V. W., and SCHUEPBACH, C., "Igniting device." July 4.
15,580.—GOODMAN, J., Executor of W. J. JENKINS deceased, and W. J. JENKINS AND CO., LTD., "Apparatus for charging retorts." July 4.
15,605.—TERRY, G., "Smoke shades." July 5.
15,639.—LAMKIN, A. E., "Gas-heating appliances." July 5.
15,712.—MACKAY, J. F., and LEESON, G. W. T., "Gas-burners." July 6.
15,765.—CONTRERAS, G., "Gas-stove for baking." July 6.
15,795.—JACOBS, F., "Mantles and burners." July 7.
15,799.—MAGEE, F. W., and BAKER, T. W., "Gas-regulator." July 7.
15,837.—CLARKE, H., and CAMPBELL, J. A., "Fuel." July 7.
15,856.—DEMPSTER, R. & J., LTD., and BEARD, G. F. H., "Scrubber-washers." July 8.
15,861.—LISMEY, W. H., "Regenerator furnace." July 8.

Parkinson's Pointed Paragraphs.

SCRAP YOUR OLD COOKER.

Parkinson's Cookers Never Grow Old.

See the Point?

Standardized Parts.

Perfect Fitting Renewals.

THE PARKINSON STOVE CO., LTD.

(Incorporating Maughan's Patent Geyser Co.),

BIRMINGHAM AND LONDON.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending July 15. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	st Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar, crude	per ton	—	20/- 23/-	23/6	19/- 22/-	19/- 22/-	—
Pitch	„	39/- 40/-	37/-	37/6	36/6	36/-	38/-
Benzol, 90%	per gallon	-/10½	-/9½	-/9	-/9¼	-/9⅛	-/10
Benzol, 50-90%	„	—	-/9⅜	-/9½	-/8 -/8¼	-/8⅜	—
Toluol, 90%	„	-/10½	-/9⅞	-/10	-/10	-/10	-/10
Crude naphtha, 30%	„	—	-/3⅜	-/4	-/3⅜	-/3½	—
Light oil, 50%	„	—	-/3½	-/3¾ -/4	-/3½	-/3¾	—
Solvent naphtha, 90-160	„	—	-/10	-/10	-/10	-/10⅛	-/11
Heavy naphtha, 90-190	„	—	-/11	-/11⅛	-/11¼	-/11¼	-/11
Creosote in bulk	„	-/2½ -/2⅝	-/2	-/2	-/2⅛	-/2 3/16 -/2⅛	-/1⅞
Heavy oils	„	—	-/2½ -/2⅝	-/2¼	-/2⅜	-/2¾	-/2⅜
Carbolic Acid, 60's	„	—	1/10	1/11	1/8½	1/8½	1/10½
Naphthalene, crude drained salts	per ton	—	43/9	41/3	47/6	47/6 50/-	—
„ pressed	„	—	60/-	63/-	60/-	60/- 72/6	—
„ whizzed	„	—	—	—	70/- 72/6	60/- 75/-	60/-
Anthracene	per unit	-/2	-/1½	-/1½	-/1¼	-/1¼	—

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments Vacant.

GAS MANAGER. Slough Gas Company. Applications by July 21.
METER REPAIRER. Derby Gas Company.
GAS-FITTER. Shotley Bridge Gas-Works.
STOKER. Ynyscynhaiarn Urban District Council. Applications by Aug. 1.

Appointments Wanted.

CLERK. No. 5420.
MANAGER. No. 5425.

Plant, &c. (Second-Hand), For Sale.

CONDENSER. Sutton Gas Company.
METERS. No. 5424.

Plant, &c. (Second-Hand), Wanted.

CAST-IRON TANK. Bishop's Stortford Gas-Works.

Meetings.

BRENTFORD GAS COMPANY. St. Ermin's Hotel. Aug. 2. Twelve o'clock.
SOUTH METROPOLITAN GAS COMPANY. De Keyser's Hotel. Aug. 9. Two o'clock.

Stocks and Shares.

HORNCASTLE WATER COMPANY (Mortgage Debentures).

TENDERS FOR

Coal.

DEVON GAS ASSOCIATION. Tenders by July 22.
HAWORTH URBAN DISTRICT COUNCIL. Tenders by July 24.
LYMM URBAN DISTRICT COUNCIL. Tenders by July 20.
MOSSLEY GAS DEPARTMENT. Tenders by July 21.
SHEFFIELD UNITED GASLIGHT COMPANY. Tenders by Aug. 1.

Condensers.

GUILDFORD GAS COMPANY. Tenders by July 28.

General Stores.

SALFORD GAS DEPARTMENT.

Pipes, &c., and Pipe-Laying.

CHAPEL, WHALEY AND DISTRICT GAS COMPANY. Tenders by Aug. 7.
DOCKING RURAL DISTRICT COUNCIL. Tenders by July 25.
NEW HUNSTANTON URBAN DISTRICT COUNCIL. Tenders by July 25.

Steelwork for Coal Store.

GUILDFORD GAS COMPANY. Tenders by July 28.

Tar and Liquor.

LYMM URBAN DISTRICT COUNCIL. Tenders by July 20.

Telpher and Coal Grab.

GUILDFORD GAS COMPANY. Tenders by July 28.

Water Tower and Tank, &c.

DOCKING RURAL DISTRICT COUNCIL. Tenders by July 25.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 158.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	82—85	..	5 17 8	4,940,000	Stk.	May 12	9	Imperial Continental	183½—185½	..	4 17 0
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	93—95*	..	4 4 3	1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	92—94	..	3 14 6
200,000	5	May 12	7	Bombay, Ltd.	6¼—6⅜	..	5 3 8	200,242	Stk.	Mar. 10	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
40,000	5	„	7	Do. New, £4 paid	5¼—5⅜	..	4 17 5	561,000	Stk.	Feb. 24	10	Liverpool United A.	215—217	..	4 12 2
50,000	10	Feb. 24	15	Bourne- 10 p.c.	28½—29½	..	5 1 8	718,100	„	„	7	Do. B.	163—165	..	4 4 10
311,810	10	„	7	mouth Gas B 7 p.c.	16⅜—16⅝	..	4 3 0	306,083	„	June 30	4	Do. Deb. Stk.	102—104	..	3 16 11
75,000	10	„	6	and Water Pref. 6 p.c.	14½—15	..	4 0 0	75,000	5	June 15	6	Malta & Mediterranean	4⅜—4⅝	..	6 3 1
380,000	Stk.	„	12½	Brentford Consolidated	257—262	..	4 15 5	560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
330,000	„	„	9½	Do. New	200—210	—½	4 10 6	250,000	100	„	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
50,000	„	„	5	Do. 5 p.c. Pref.	122—124	..	4 0 8	541,920	20	May 31	3½	Monte Video, Ltd.	12⅞—13⅛	..	5 5 8
206,250	„	June 15	4	Do. 4 p.c. Deb.	97—99	..	4 0 10	1,775,892	Stk.	Feb. 24	4½	Newc'tle&G'tesh'd Con.	103½—104½	..	4 3 9
220,000	Stk.	Mar. 10	11	Brighton & Hove Orig.	217—220	..	5 0 0	529,705	Stk.	June 30	3½	Do. 3½ p.c. Deb.	87—89	..	3 18 8
246,320	„	„	8	Do. A Ord. Stk.	157—160	..	5 0 0	55,940	10	Mar. 10	7	North Middlesex 7 p.c.	15—16	..	4 7 6
490,000	20	Apl. 12	11⅞	British	44½—45½	+½	5 3 5	300,000	Stk.	Apl. 27	8	Oriental, Ltd.	137—139	..	5 15 1
120,000	Stk.	June 30	4	Do. 4 p.c. Deb. Stk.	94—96	..	4 3 4	60,000	5	Apl. 12	8	Ottoman, Ltd.	6¾—7¼	..	5 10 4
109,000	„	Feb. 10	6	Bromley, A 5 p.c.	116—118	..	5 1 8	31,800	53	Feb. 24	13	Portsea Island A	135—140	..	4 18 4
165,700	„	„	4½	Do. B 3½ p.c.	87—89	..	5 1 2	60,000	50	„	13	Do. B	—	..	—
82,278	„	„	5½	Do. C 5 p.c.	106—108	..	5 1 10	100,000	50	„	12	Do. C	120—125	..	4 16 0
55,000	„	June 30	3½	Do. 3½ p.c. Deb.	82—84	..	4 3 4	114,800	50	„	10	Do. D and E.	—	..	—
250,000	Stk.	„	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6	398,490	5	May 31	8	Primitiva Ord.	7⅞—7⅞	..	5 3 3
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—	796,980	5	June 30	5	Do. 5 p.c. Pref.	5¼—5½	..	4 10 11
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—	488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—	312,650	Stk.	June 30	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
100,000	Stk.	June 30	4½	Do. 4½ p.c. Deb. Stk.	80—83	—½	5 8 5	250,000	10	Mar. 24	9	San Paulo, Ltd.	21½—22½	..	4 0 0
157,150	Stk.	Feb. 24	5	Chester 5 p.c. Ord.	109—111	..	4 10 1	115,000	10	„	6	Do. 6 p.c. Pref.	12—12½	..	4 16 0
1,513,280	Stk.	„	5 9/4	Commercial 4 p.c. Stk.	114—116	..	4 14 3	125,000	50	July 1	5	Do. 5 p.c. Deb.	49—50	..	5 0 0
560,000	„	„	5½	Do. 3½ p.c. do.	108—110	..	4 16 11	135,000	Stk.	Mar. 24	10	Sheffield A	236—238	+1	4 4 0
475,000	„	June 15	3	Do. 3 p.c. Deb. Stk.	75½—77½	..	3 17 5	209,984	„	„	10	Do. B	236—238	+1	4 4 0
800,000	Stk.	May 31	4	Continental Union, Ltd.	92—95	..	4 4 3	523,500	„	„	10	Do. C	236—238	+2	4 4 0
200,000	„	„	7	Do. 7 p.c. Pref.	135—137	..	5 2 2	70,000	10	June 15	7	South African	8½—9½	..	7 7 4
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9	6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	119—121	..	4 10 3
55,000	„	—	4	Do. Deb. Stk.	104—105	..	3 16 2	1,895,445	„	July 14	3	Do. 3 p.c. Deb.	78½—80½*	..	3 14 6
148,995	„	Apl. 12	5	East Hull 5 p.c. Ord.	—	..	—	209,820	Stk.	Mar. 10	8	South Shields Con. Stk.	154—156	..	5 2 7
840,150	10	Jan. 27	10	European, Ltd.	19—20	..	5 0 0	605,000	Stk.	Feb. 24	5⅜	S'th Suburb'n Ord. 5 p.c.	119—121	..	4 13 6
16,179,445	Stk.	Feb. 24	4⅛	Gas- 4 p.c. Ord.	106½—107½	..	4 6 9	60,000	„	„	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
2,600,000	„	„	3⅛	light 3½ p.c. max.	85—87	..	4 0 6	117,058	„	July 14	5	Do. 5 p.c. Deb. Stk.	121—123*	..	4 1 4
4,062,235	„	„	4	and 4 p.c. Con. Pref.	103—105	..	3 16 2	502,310	Stk.	May 12	5	Southampton Ord.	109—111	..	4 6 11
4,531,705	„	June 15	3	Coke 3 p.c. Con. Deb.	78½—80½	..	3 14 6	120,000	Stk.	Feb. 10	7	Tottenham A 5 p.c.	147—150	..	4 13 4
258,740	Stk.	Mar. 10	5	Hastings & St. L. 3½ p.c.	95—97	..	5 3 1	483,940	„	„	5⅜	and B 3½ p.c.	116½—118½	..	4 12 10
82,500	„	„	6⅓	Do. do. 5 p.c.	—	..	—	149,470	„	June 15	4	Edmonton 4 p.c. Deb.	96—98	..	4 1 8
70,000	10	Apl. 27	11	Hongkong & China, Ltd.	17⅞—18	+½	6 2 2	182,380	10	June 15	8	Tuscan, Ltd.	8⅜—9½	..	8 13 0
131,000	Stk.	Mar. 10	7⅜	Ilford A and C	147—150	..	4 18 4	149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
65,780	„	„	5⅛	Do. B	119—122	+1	4 16 3	236,476	Stk.	Feb. 24	5	Tynemouth, 5 p.c. max.	115—117	..	4 5 6
65,500	„	June 30	4	Do. 4 p.c. Deb.	94—96	..	4 3 4	255,636	Stk.	Feb. 24	6⅜	Wands- B 3½ p.c.	141—143	..	4 14 5
								85,766	„	June 30	3	worth 3 p.c. Deb. Stk.	71—73	..	4 2 2

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